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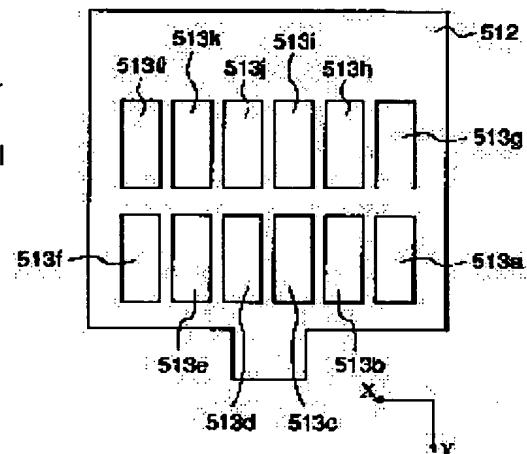
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(54) IMAGE-RECORDING APPARATUS AND ITS CONTROL METHOD AND RECORDING APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To record color images and monochromatic high-gradation images to the same recording medium.

SOLUTION: This apparatus has color recording heads 513a-513f which can discharge at least one kind of color ink, monochromatic recording heads 513g-513l which can discharge a monochrome ink, and a recording control part which discharges the ink to a sheet while relatively moving these recording heads to the sheet and selectively records color images and monochromatic images. A count of densities of the monochrome ink is larger than a count of densities of the color ink.



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CLAIMS

[Claim(s)]

[Claim 1] the following — having — the kind of concentration of the aforementioned black ink — the above — the image recording equipment characterized by making [more] it than the kind of concentration of the color ink about which color ink It is the 1st record nozzle group in which the regurgitation is possible about at least one kind of color ink. It is the 2nd record nozzle group in which the regurgitation is possible about black ink. this — the record control means on which a color picture and a monochrome picture are made to record alternatively by moving relatively the 1st and 2nd record nozzle groups to a record medium, and making this record medium breathe out ink

[Claim 2] The aforementioned image recording equipment is image recording equipment according to claim 1 characterized by being used for record of a medical-application picture.

[Claim 3] The record nozzle group of the above 1st is image recording equipment according to claim 1 or 2 characterized by having two or more nozzle groups in which the regurgitation is possible for the ink in which at least one kind of color ink ***** differs from the concentration of two or more kinds of shades.

[Claim 4] The aforementioned record control means are image recording equipment given in the claim 1 characterized by making a color picture and a monochrome picture higher than the concentration gradation about each monochrome of this color picture the same record medium recordable, or any 1 term of 3.

[Claim 5] The aforementioned record control means are image recording equipment according to claim 4 characterized by dividing a record section into the same record medium, and recording a color picture and a monochrome picture on it.

[Claim 6] The aforementioned record control means are image recording equipment according to claim 5 characterized by what is divided and recorded on a color picture record section and a monochrome image recording field based on the picture signal sent from the external instrument.

[Claim 7] The aforementioned color ink is image recording equipment given in three kinds, cyanogen, a Magenta, and yellow, or red, green, the claim 1 characterized by being three blue kinds, or any 1 term of 6.

[Claim 8] It is image recording equipment given in the claim 1 which there are a maximum of two kinds of shade of the aforementioned color ink, and is characterized by the kind of shade of the aforementioned black ink being three or more kinds, or any 1 term of 7.

[Claim 9] Image recording equipment given in the claim 1 characterized by carrying an ink cartridge in a predetermined record nozzle group, supplying ink in the above 1st and the 2nd record nozzle group, connecting an ink supply means to the remaining record nozzle group, and supplying ink, or any 1 term of 8.

[Claim 10] It is image recording equipment according to claim 9 characterized by for the aforementioned color ink being supplied by the ink cartridge and the aforementioned black ink being supplied by the aforementioned ink supply means.

[Claim 11] The 1st and 2nd record nozzle groups are image recording equipment according to claim 1 characterized by having further two or more nozzle groups, and supplying ink to some

nozzle groups from an ink cartridge among two or more of these nozzle groups in the first half.

[Claim 12] At least one kind of color ink The 1st record nozzle group in which the regurgitation is possible, black ink — the 2nd record nozzle group in which the regurgitation is possible — this, moving relatively the 1st and 2nd record nozzle groups to a record medium Make this record medium breathe out ink and it has the record control means on which a color picture and a monochrome picture are made to record alternatively. In the image recording equipment made [more] than the kind of concentration of the color ink about which color ink the kind of concentration of the aforementioned black ink — the above — the aforementioned record control means The control method of the image recording equipment characterized by dividing a record section and recording a color picture and a monochrome picture on it at the same record medium while making a color picture and a monochrome picture higher than the concentration gradation about each monochrome of this color picture the same record medium recordable.

[Claim 13] The aforementioned record control means are the control methods of the image recording equipment according to claim 12 characterized by what is divided and recorded on a color picture record section and a monochrome image recording field based on the picture signal sent from the external instrument.

[Claim 14] The aforementioned color ink is the control method of three kinds, cyanogen, a Magenta, and yellow, or red, green, and the image recording equipment according to claim 12 or 13 characterized by being three blue kinds.

[Claim 15] It is the control method of image recording equipment given in the claim 12 which there are a maximum of two kinds of shade of the aforementioned color ink, and is characterized by the kind of shade of the aforementioned black ink being three or more kinds, or any 1 term of 14.

[Claim 16] The control method of image recording equipment given in the claim 12 characterized by carrying an ink cartridge in a predetermined record nozzle group, supplying ink in the above 1st and the 2nd record nozzle group, connecting an ink supply means to the remaining record nozzle group, and supplying ink, or any 1 term of 15.

[Claim 17] The 1st and 2nd record nozzle groups are the control methods of the image recording equipment according to claim 12 characterized by having further two or more nozzle groups, and supplying ink to some nozzle groups from an ink cartridge among two or more of these nozzle groups in the first half.

[Claim 18] The recording device characterized by there being more gradation which can be expressed in two or more aforementioned black ink than the number of gradation which can be expressed in the aforementioned color ink in the recording device which performs gradation record using two or more black ink in which concentration differs, and color ink.

[Claim 19] The recording device according to claim 18 which has the combination table of two or more black ink in which the aforementioned concentration differs, and the combination table of the color ink in which concentration differs, and is characterized by there being more gradation of the aforementioned table corresponding to black ink than the number of gradation of the aforementioned table corresponding to color ink.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to image recording equipment, its control method, and a recording device.

[0002]

[Description of the Prior Art] In recent years, the color printer recordable on a record medium has spread the color picture. However, since there are problems, like recording rate becomes slow like the after-mentioned when it is going to record monochrome pictures, such as a character, by the color printer, the color printer which used the color ink head and the black ink head properly if needed, and enabled record of a color picture and a monochrome picture at the same record medium by carrying both the color ink head for color picture record and the black ink head for binary image recording is proposed.

[0003]

[Problem(s) to be Solved by the Invention] By the way, in the medical field using an X-ray photograph, an CT-MRI picture, etc., the monochrome picture is still used abundantly. the reason — the concentration of human being's eyes — since resolution is high — high concentration — in the medical field as which resolution is required, it is because there is much amount of information which the monochrome picture can recognize by the eye rather than a color picture [0004] furthermore, the concentration which rather than can recognize [which uses the record medium of a transparency formula] by human being's eyes using the record medium of a reflective formula — resolution is high and the bird clapper is known the concentration of human being's eye [as opposed to a color picture generally] — resolution is said to be 10 or 11 bits about the monochrome transparency picture to being about 8 bits

[0005] and an X-ray photograph and an CT-MRI picture are offered as a medical-application picture by recording on the record medium of a transparency formula — having — a doctor — the concentration of human being's eyes — resolution — a diagnostic result is obtained by reading a picture in a limit However, also by the picture used for the same medical field, the color picture is used abundantly in order for ultrasonic diagnosis, nuclear medicine equipment, an endoscope, a fundus-of-the-eye photography picture, a pathology microphotography, etc. to express the functional information of living bodies, such as a state of the purpose which obtains a living body's sexual desire news, or a blood flow.

[0006] Then, conventionally, the recording device for color picture record and the recording device for monochrome high gradation image recording were prepared separately, and these were used properly. For this reason, management of the picture which could not record a color picture and a monochrome high gradation picture on the same record medium, but was recorded on it was also complicated.

[0007] Moreover, although there is also a recording device for color picture record which can record a monochrome picture, there is a fault that it is inferior by gradation expression compared with the recording device only for monochrome pictures. Moreover, it needed to use properly, exchanging the record medium for color picture record, and the record medium for monochrome image recording according to a use, respectively.

[0008] As an example of such a recording device, there is a thing of a sublimated type hot printing method. This prepares three kinds of ink ribbons (color) of Y, M, C, or R, G and B, is in the state which piled up the ink ribbon and the record medium—ed, heats them partially by the thermal head, and forms a picture by imprinting through the color of an ink ribbon. A color picture can be formed by repeating the process same about three kinds of ink ribbons 3 times. What is necessary is just to pile all of three kinds of ink up equally by this method, in order to record monochrome. However, it is difficult to express the neutral monochrome which does not have a tint in three kinds of colors in order to express monochrome in piles by this method. Moreover, concentration (for example, OD3) of sufficient monochrome cannot be expressed especially to a transparency medium.

[0009] So, when you needed neutral monochrome concentration or neutral monochrome concentration deep enough, it had acquired the picture by carrying out the melanism of the portion which the medium for monochrome pictures of a sensible-heat formula was prepared [portion] independently, was partially heated [portion] by the above-mentioned thermal head, and made it heat. That is, while exchanging the medium for color pictures, and the medium for monochrome pictures, it was what detaches and attaches an ink ribbon if needed.

[0010] Another method is an ink-jet method. In this case, three kinds of ink of Y, M, C, or R, G and B is prepared, and a color picture can be expressed by piling up three colors. When expressing monochrome also in this case, three colors can be expressed in piles equally. However, in order to pile up three colors like a sublimated type hot printing method also in this case, it is difficult to express neutral monochrome without a tint. Moreover, although ink had to be piled up to the same pixel in order to express the concentration (for example, OD3) of sufficient monochrome especially to a transparency medium, there is a limitation in the ink absorption capacity of a medium, and sufficient monochrome concentration was not able to be expressed. That is, although the overprint of the ink is carried out to the same pixel in order to take out gradation to a picture, and in order to make concentration deep, if there is a limitation in the ink absorbed dose of a record medium—ed and it piles up exceeding this limitation, ink will overflow and a picture will bleed.

[0011] It is this invention's being made in view of an above-mentioned technical problem, being able to record the purpose, without exchanging a record medium and an ink ribbon by the color picture and the monochrome high gradation picture, and providing the same record medium with the image recording equipment which can record a color picture and the good monochrome high gradation picture of grace, its control unit, and a recording device if needed.

[0012]

[Means for Solving the Problem] An above-mentioned technical problem is solved, and in order to attain the purpose, the image recording equipment of this invention is equipped with the following composition. At least one kind of color ink Namely, the 1st record nozzle group in which the regurgitation is possible, black ink — the 2nd record nozzle group in which the regurgitation is possible — this, moving relatively the 1st and 2nd record nozzle groups to a record medium the record control means on which make this record medium breathe out ink and a color picture and a monochrome picture are made to record alternatively — having — the kind of concentration of the aforementioned black ink — the above — it was made [more] than the kind of concentration of the color ink about which color ink

[0013] In order to solve the above-mentioned problem, in this invention, among the ink of Y, M, C, or R, G and B, the monochrome ink of the shade of many kinds is prepared, and a picture to record is divided into a monochrome field and a color field, and about a color field, it is color ink, and records in monochrome ink about a monochrome field rather than most colors of the kind of shade.

[0014] Moreover, the control method of the image recording equipment of this invention is equipped with the following features. At least one kind of color ink Namely, the 1st record nozzle group in which the regurgitation is possible, black ink — the 2nd record nozzle group in which the regurgitation is possible — this, moving relatively the 1st and 2nd record nozzle groups to a record medium Make this record medium breathe out ink and it has the record control means on which a color picture and a monochrome picture are made to record alternatively. In the image

recording equipment made [more] than the kind of concentration of the color ink about which color ink the kind of concentration of the aforementioned black ink -- the above -- the aforementioned record control means While making a color picture and a monochrome picture higher than the concentration gradation about each monochrome of this color picture the same record medium recordable, a record section is divided and a color picture and a monochrome picture are recorded on it at the same record medium. It became possible to lessen the number of times of an overprint to the same pixel, and to express the gradation of monochrome, and high concentration by this. Moreover, the recording device of this invention is equipped with the following composition. That is, in the recording device which performs gradation record using two or more black ink in which concentration differs, and color ink, there is more gradation which can be expressed in two or more aforementioned black ink than the number of gradation which can be expressed in the aforementioned color ink.

[0015]

[Embodiments of the Invention] Below, the operation gestalt of this invention is explained in detail with reference to an accompanying drawing.

[Mechanical composition] drawing 1 is the perspective diagram showing the principal part (Records Department) of the ink-jet recording device of the operation gestalt concerning this invention, drawing 2 A is the side elevation seen from the view A of drawing 1, and drawing 3 and drawing 4 A and drawing 4 B are the partial detail drawing of the recording head of drawing 1.

[0016] In drawing 1 and drawing 2 A, the sheet with which 501 has a picture recorded, 502, 503 and 504, and 505 are rollers which become a pair and convey a sheet in the direction of X, respectively. The diameter expansion section 506 is formed in a longitudinal direction at intervals of predetermined, and, as for a roller 505, the diameter expansion section 506 contacts a sheet. It is the pulley with which 507 was attached in the motor and 508 was attached in the motor shaft, and the pulley with which 509 and 510 were attached in the end of rollers 502 and 504, and is combined with the pulley 508 with the belt 511, and rollers 502 and 504 rotate by rotation of a motor. Moreover, by energization means by which it does not illustrate, rollers 503 and 505 are energized in the direction which presses rollers 502 and 504, respectively, put a sheet with each roller, and convey it in the direction of X.

[0017] 512 is the carriage which carries two or more heads 513a-513l., and as shown in each head at drawing 4 A, it is prepared in the position where many nozzles counter a sheet side. 516 and 517 are the shafts held possible [sliding of carriage], and 516 has the structure where the height 519 which penetrated the hole 518 prepared in carriage, and was installed by carriage 512 contacts on a shaft 517.

[0018] It is arranged so that the field in which the nozzle of a head 513 was prepared may counter a sheet at intervals of [d] predetermined by the above composition. 520 is the belt fixed to carriage 512 in the part, and has combined between the pulleys 524 attached in the pulley 522 and the fixed shaft 523 which were attached in the driving shaft of a motor 521 possible [rotation].

[0019] By the above composition, both-way movement of carriage is attained along the direction of Y by rotation of a motor 521, and it becomes movable to position-in-readiness 512a and a symmetric position about position-in-readiness 512a and the sheet of the direction whole region of Y of a sheet, and carriage. In addition, while moving in a sheet top, the interval d of a nozzle side and a sheet is constituted so that it may be held uniformly. 526a-526l., it is the ink cartridge which put in ink, and Heads 513a-513l. are equipped, and ink is supplied to a head. A head cartidge 526 can supply ink by removing and attaching a new ink cartridge, if attachment and detachment are free and the ink of an ink cartridge is lost to a head 513.

[0020] 12 kinds of ink cartridges are prepared. The items are six kinds from which concentration differs in two kinds of cyano shades, two kinds of Magenta shades, two kinds of yellow shades, and black ink in an order from 526a. The 2nd nozzle group for black ink which has six nozzle groups (513g-513l.), and the 2nd nozzle group for color ink which has six nozzle groups (513a-513f) correspond to the kind of this ink cartridge. In addition, it is good in an order from 526a also as that from which concentration differs in two kinds of red shades, two kinds of green

shades, two kinds of blue shades, and black ink instead of using these ink. Heads 523a-523l. can be equipped with these different cartridges, respectively. 525 is the sheet guide prepared between a roller 502 and 504, and the relief of a sheet is prevented because drawing 2 A goes caudad by suction means by which it does not illustrate, attract a sheet by air and a sheet sticks to a sheet guide with the suction force from the stoma of a large number prepared in the field which touches a sheet. If a sheet comes floating, it becomes impossible to hold an interval d naturally, and a sheet may collide with a head. 515 is a dot formed on a sheet, when ink is breathed out on a sheet from a nozzle.

[0021] In addition, although constituted from a separate head for every color, two or more colors or the head of concentration is really considered as composition, the inside of one head is divided into two or more nozzle groups, and you may make it assign a color or concentration for every nozzle group in this example.

[Electrical circuit composition] drawing 5 is the block diagram of the control circuit which manages various control of the ink-jet recording device of this operation gestalt.

[0022] As shown in drawing 5, as for 1, image data is inputted through an external instrument or a network in the picture input sections, such as a scanner. It is the picture field separation section, 1' divides into a monochrome picture field and a color picture field the image data inputted into the picture input section 1, and about each field, if it is a monochrome picture field and it is the concentration data and the color picture field to each pixel, it will obtain the concentration data to each pixel about each color whose color was separated into cyanogen, a Magenta, yellow or red, green, and three blue colors. A control unit equipped with the various keys 2 instructs a setup and printing start of various parameters to be, and 3 are CPUs which control this whole recording device according to the various programs in a storage.

[0023] 4 is a storage which stores the program for operating this recording device according to a control program or an error-processing program etc. All operation of this operation gestalt is operation by this program. As a record medium 4 which stores this program, ROM, FD, CD-ROM, HD, memory card, a magneto-optic disk, etc. can be used.

[0024] The ink kind distribution table (ink kind combination table) for referring to the gamma correction translation table for referring to 4a by gamma transform processing in a storage 4 and 4b by processing of below-mentioned ink kind distribution and 4d of program groups which store various programs are shown, respectively.

[0025] 5 is RAM used as the work area of the various programs in a storage 4, the momentary shunting area at the time of error processing, and a work area at the time of an image processing. Moreover, RAM5 can also advance an image processing, changing the content of the table after copying the various tables in a record medium 4, and referring to this changed table.

[0026] 6 is the image-processing section which creates the regurgitation pattern for realizing high gradation by the ink jet based on an input picture.

[0027] 7 is a printer which forms a dot picture based on the regurgitation pattern created in the image-processing section at the time of record, and includes the Records Department which showed drawing 1. 8 is a bus line which transmits the address signal in this equipment, data, a control signal, etc.

The image-processing section 6 is explained with reference to the [image-processing section], next drawing 6.

[0028] The gamma correction processing 11 is changed into the signal CD with which concentration is expressed using gamma correction translation table 4a prepared about monochrome and color each color, respectively in the picture signal valve flow coefficient inputted in the picture input section 1, and is stored in the page memory field of the image-processing work area of RAM5. With this operation gestalt, the monochrome picture makes the level division of CD value 8 bits about 12 bits and color each color, respectively.

[0029] The attention pixel selection 12 chooses from this in a page memory field 1 pixel which is going to carry out processing, and obtains the concentration data CD.

[0030] In the ink kind distribution processing 13, the combination of the ink kind which expresses the concentration near the concentration CD of an attention pixel with reference to ink kind distribution table 4b based on CD value of an attention pixel is chosen. In the concentration

error calculation 15, the difference of the concentration and CD value of an attention pixel which can be expressed in the combination of the ink chosen by the ink kind distribution processing 13 is computed. this combination — also being based — the binary signals d1, d2, and d3 of the regurgitation of the head of each concentration and the non-regurgitation and — are determined

[0031] the error diffusion process 16 — the above — difference is distributed to the pixel of the circumference which has not yet carried out ink kind distribution processing by the predetermined method, and addition or subtraction is carried out to CD value of an applicable pixel

[0032] The observed 1-pixel processing is completed by performing the above processing.

[0033] Here, ink kind distribution table 4b is explained. The ink to be used, the concentration information at the time of recording, etc. are recorded on ink kind distribution table 4b about the kind and concentration of ink, and an operating combination and its concentration information on an operating combination and the concentration information on the shade ink of CMY each color as shown below, and the shade ink to the black in an achromatic locus are included in it in this operation gestalt. To CMY, it is a total of six kinds and six kinds of ******, and shade ink is indicated to be 1, 2, and 3 — by the suffix sequentially from the one where concentration is higher. The rate of the color ratio of concentration of these ink is shown in Table 1. Table 1 shows the color ratio of concentration and reflection density of various ink. In addition, ink consists of a color and a solvent and various additives, such as a surfactant and moisturization material, are contained in the solvent. These additives control the regurgitation property from a head, and the absorption property in the television paper.

[0034]

[Table 1]

	C1	C2	M1	M2	Y1	Y2
染料濃度 比率 (%)	3.5%	0.9%	3.5%	0.9%	3.5%	0.9%
反射濃度 (O.D.)	1.88	0.51	1.58	0.59	1.58	0.59

	K1	K2	K3	K4	K5	K6
染料濃度 比率 (%)	4.8%	2.4%	1.2%	0.6%	0.3%	0.15%
反射濃度 (O.D.)	1.67	0.96	0.51	0.27	0.13	0.07

[0035] Using these ink, to CMY, 1 pixel is formed by a maximum of two ink dots, and 1 pixel is formed by a maximum of four ink dots in an achromatic locus to K. This result is shown in drawing 2 B and drawing 2 C. The number in drawing shows the number of the ink dots which carry out the regurgitation to one pixel, and zero breathe out and twist the ink and show things. Moreover, the column of concentration level shows the value made to correspond to a 8-bit input picture signal (for 0-255:0 to be the highest concentration) by CMY. That is, multiple-value-ized processing of five values will be performed about CMY, and multiple-value-ized processing of 43 values will be performed by the achromatic locus about K corresponding to a 12-bit input picture signal (zero to 4095:0 is the highest concentration). As mentioned above, the table on which the ink of each color when recording in chromatic color (Y, M, C) ink in this operation gestalt, as shown by drawing 2 B can respond to five concentration level is prepared. When recording in achromatic color (BK) ink, the table which can respond to more concentration level of 42 than the concentration level (the number of gradation expression) of chromatic color (Y, M, C) ink as shown by drawing 2 C is prepared. In recording, it records by choosing the combination of the ink kind corresponding to the gradation value which should be recorded, respectively. the attention pixel selection 12 of the above-mentioned based on the concentration data CD of a picture, and processing of the ink kind distribution processing 13 — all pixels — the binary signals d1, d2, and d3 of the regurgitation for every pixel to each head with different concentration and the non-regurgitation and — are formed by repeating a number. The above processing is performed one by one about each color of a monochrome picture and a color picture using each ink kind distribution table. In addition, the image-processing section is

prepared about monochrome and each color, respectively, and it is parallel and you may process.

[0036] When recording, a sheet 501 is sent in among rollers 502 and 503 from the left of drawing by means by which it does not illustrate, by drawing 2 A. Subsequently, a sheet is sent to a predetermined distance [every] intermittent target in the direction of X by the motor 507. While the sheet has stopped, a motor 521 rotates and carriage is moved in the direction of Y at a fixed speed. While the head on carriage passes through a sheet top, the nozzle regurgitation command signal corresponding to the picture signal is sent by the control circuit of drawing 5 and drawing 6 , and a drop is alternatively breathed out from each nozzle according to this. While being in the position distant from on the sheet, a motor 507 moves a sheet in the direction of predetermined distance X, and stops, and a motor 507 moves a sheet at predetermined speed, and makes a drop for a head to pass through a sheet top and breathe out alternatively similarly again here. Finally by repeating this below, a desired picture is recorded on a sheet. The sheet which record ended is conveyed leftward [of drawing 2 A] in 504 and 506, and, subsequently to the left of drawing 2 A, is discharged with a conveyance means by which it does not illustrate.

[0037] The example of record by this recording device is shown in drawing 7 . As for an X-ray picture and 532, 531 is [CT picture and 533] MRI pictures, and gradation expression of each of these is carried out by 12 bits by the monochrome picture. 534 is an endoscope picture, 535 is an eyegrounds picture, these two are a color picture and gradation expression is carried out in each color of 8 bits. Thus, if the same patient's picture is collectively recorded on the sheet of one sheet, correspondence is easy and convenient.

[0038] Drawing 8 is the example of record of another picture. Although 537 is a color Doppler ultrasonic wave picture and most is a monochrome high gradation picture, only Kurobe 538 serves as a color picture and is expressing the state of a blood flow according to a color.

[0039] Thus, the algorithm which carries out high gradation record using three or more kinds of black shade ink is indicated by Japanese Patent Application No. No. 78423 [nine to], for example. Moreover, the algorithm which records a color picture using the color ink of two kinds of shades is indicated by JP,6-226998,A. What is necessary is just to record with each algorithm to each field, when dividing a field and recording a monochrome picture and a color picture.

[Image recording equipment of 2nd operation gestalt] drawing 9 shows the image recording equipment of the 2nd operation gestalt.

[0040] The same component as drawing 1 is omitting in drawing 9 .

[0041] In drawing 9 , reserve tanks 540a-540l. are attached in the head 513, and the ink of a constant rate is accumulated at it. Every one tube 541 each is connected from reserve tanks 540a-540l., and this tube is connected with the ink tanks 544a-544l. which correspond via the pump meanses 545a-545l., respectively, and if the amount of ink of a reserve tank decreases, it will supply ink to a reserve tank from an ink tank by the pump means. When the ink tank is constituted by equipment removable where it was removable in the tube and a tube is removed according to the attachment-and-detachment mechanism in which it does not illustrate, and an ink tank becomes empty, a tube is extracted, an ink tank is exchanged for a new thing, and ink is supplied by equipping with a tube again. The kind of ink is the same as the 1st operation gestalt. A tube is packed into the tube bunch 542 and pars intermedia is fixed by the tube holddown member 543. Between the reserve tank and the tube holddown member, in case it has ridden on the tube guide 546 and carriage moves, movement of on a tube guide of a tube bunch is attained so that movement of carriage may not be barred.

[0042] Although it is the same as that of the 1st operation gestalt about record operation, since there is much more capacity of an ink tank than the capacity of an ink cartridge, in recording in large quantities, compared with the frequency of exchange of an ink cartridge, the exchange frequency of an ink tank is low and its frequency of ink supply decreases.

[Image recording equipment of 3rd operation gestalt] drawing 10 shows the image recording equipment of the 3rd operation gestalt. In drawing 10 , the same component as drawing 1 and drawing 9 is omitting.

[0043] In drawing 10 , ink cartridges 526a-526f are attached in Heads 513a-513f like drawing 1 , and reserve tanks 540g-540l. are attached in Heads 513g-513l. like drawing 9 . One tube is

connected to a reserve tank like drawing 9, respectively, and it connects with the ink tanks 544g-5441l, via the pump meances 545g-545l. And about Heads 513a-513f, ink is supplied by exchanging ink cartridges, and ink is supplied by exchanging the ink tanks 544g-544l, about Heads 513g-513l. This decreases from the case where the number of the tube of ink, an ink tank, and pumps is drawing 9, and equipment is simplified. On the other hand, although the time and effort of ink cartridge exchange increases from the case of drawing 9 about Heads 513a-513f, since there are few color fields by the reason for explaining below when usually recording a picture like drawing 7 or drawing 8, there is little trouble.

[0044] That is, as for the picture of which monochrome high gradation, such as an X-ray picture and CT-MRI, is required, a sheet also usually has a large inclination. For example, as for a color picture, A4 size is used well, and, as for monochrome high gradation ****, cutting-into-half size (35x43cm) is used well. Moreover, a monochrome high gradation picture records the highest concentration for example, on about 3.0 OD value in many cases deeply.

[0045] As mentioned above, in using image recording equipment for a medical-application picture, there is the feature that it is remarkable and much consumption of black ink is compared with the consumption of color ink. Therefore, relatively, about color ink with little amount used, even if it supplies by the cartridge, exchange frequency does not increase so much. That is, the time and effort of the ink supply also as composition of drawing 10 seldom increases, but can also simplify equipment.

[Other operation gestalten] There is especially no limit about the method of an ink jet. Although this example described the example which uses the ink of a liquid, you may melt and carry out the regurgitation of the solid ink. In this case, supply of ink will exchange solid ink.

[0046] The size of a sheet is not restricted to one kind. Especially, by the monochrome pixel and the color picture, since the sizes of the sheet used by preference differ, the merit of this invention increases by the ability of two or more sheets to be used.

[0047] a sheet — reflection and transparency — any are sufficient By the medical-application picture, since a transparency sheet uses a reflective sheet for a color picture and a monochrome picture, being fond, that a reflective sheet or a transparency sheet can also be used increases the merit of this invention.

[0048] The method which records while send a sheet to an intermission, it does not remain in this operation gestalt which is made to move a head in the direction which intersects perpendicularly with a sheet feed direction, and is recorded on it while the sheet has stopped, but a sheet is sent by fixed speed, the line-like fixed head is prepared so that sheet width of face may be covered in the direction which intersects perpendicularly with the feed direction of a sheet, and a sheet is sent by fixed speed may be used. In this case, it equips with the head of the length which covers the width of face of a sheet about the becoming ink, alias each.

[0049] Although black ink was made into the tube supply method and color ink was made into the cartridge type with the 3rd operation gestalt, some black ink is sufficient as a tube supply method. In this case, it is appropriate to make ink with much amount used into a tube method. In the case of a medical-application picture, since a background is recorded in many cases by the highest concentration, there is an inclination with much [deep black ink] amount used. Then, it is possible to consider deep black ink as tube supply. Moreover, conversely, color ink is made into a tube supply method, a cartridge type, then a color picture are mainly used in black ink, and the monochrome picture is suitable when operating frequency is low.

[0050] You may accept and constitute a part of color ink. For example, what is necessary is for there to be also no full color need and to be able to use only some color ink, when it is said that the notes which do not record the living body picture of medical application, but attach an accent to a monochrome picture and which put a mark in a color for stratification are filled in.

[0051] Moreover, the picture signal of the monochrome field of the picture of not only when separating into a monochrome field and a color field from the picture in which the monochrome field of one sheet and a color field are included, but one sheet, and the picture signal of a color field may be received separately, and you may record on the medium of one sheet. Moreover, the monochrome picture of two or more sheets and a color picture may be received, and a field may be divided and recorded on the medium of one sheet.

[0052] Especially the gestalt of the above operation is equipped with meanses (for example, an electric thermal-conversion object, a laser beam, etc.) to generate heat energy as energy used also in an ink-jet recording method in order to make the ink regurgitation perform, and can attain the densification of record, and highly minute-ization by using the method which makes the change of state of ink occur with the aforementioned heat energy.

[0053] About the typical composition and typical principle, what is performed using the fundamental principle currently indicated by the U.S. Pat. No. 4723129 specification and the 4740796 specification, for example is desirable. Although this method is applicable to both the so-called on-demand type and a continuous system On the electric thermal-conversion object which is especially arranged corresponding to the sheet and liquid route where the liquid (ink) is held in the on-demand type case By impressing at least one driving signal which gives the rapid temperature rise which corresponds to recording information and exceeds film boiling Since make an electric thermal-conversion object generate heat energy, the heat operating surface of a recording head is made to produce film boiling and the foam in the liquid (ink) corresponding to this driving signal can be formed by 1 to 1 as a result, it is effective. A liquid (ink) is made to breathe out through opening for regurgitation by growth of this foam, and contraction, and at least one drop is formed. If the shape of a pulse form is carried out, since growth contraction of a foam will be appropriately performed instance in this driving signal, the regurgitation of a liquid (ink) excellent in especially responsibility can be attained, and it is more desirable.

[0054] As a driving signal of the shape of this pulse form, what is indicated by the U.S. Pat. No. 4463359 specification and the 4345262 specification is suitable. In addition, if the conditions indicated by the U.S. Pat. No. 4313124 specification of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, further excellent record can be performed.

[0055] The composition using the U.S. Pat. No. 4558333 specification and U.S. Pat. No. 4459600 specification which indicate the composition arranged to a delivery which is indicated by each above-mentioned specification as composition of a recording head, the liquid route, and the field to which the heat operating surface other than the combination composition (a straight-line-like liquid flow channel or right-angled liquid flow channel) of an electric thermal-conversion object is crooked is also included in this invention. In addition, it is good also as composition based on JP,59-138461,A which indicates the composition whose opening which absorbs the pressure wave of JP,59-123670,A which indicates the composition which makes a common slot the regurgitation section of an electric thermal-conversion object to two or more electric thermal-conversion objects, or heat energy is made to correspond to the regurgitation section.

[0056] Furthermore, any of the composition which fills the length with the combination of two or more recording heads which are indicated by the specification mentioned above as a recording head of the full line type which has the length corresponding to the width of face of the maximum record medium which can record a recording device, and the composition as one recording head formed in one are sufficient.

[0057] In addition, the composition of the recording head of the cartridge type with which the ink tank was formed in the recording head itself in one as the composition explained with the gestalt of the above-mentioned operation and different composition may be used, and the electric connection with the main part of equipment and supply of the ink from the main part of equipment may use the recording head of the exchangeable chip type which becomes possible by not only this but the main part of equipment being equipped.

[0058] Moreover, since record operation is further made to stability, it is desirable to add the recovery means against a recording head, a preliminary means, etc. to the composition of the recording device explained above. If these are mentioned concretely, there is a preheating means by the capping means, the cleaning means, the pressurization or the suction means, the electric thermal-conversion object, the heating elements different from this, or such combination over a recording head etc. Moreover, it is effective in order to perform record stabilized by having the reserve regurgitation mode in which the regurgitation different from record is performed.

[0059] Furthermore, by constituting a recording head in one, even with two or more combination, although it is good, it can also consider as equipment equipped with full color at least one by the

double color color of a different color, or color mixture.

[0060] In the gestalt of the operation explained above, although it is explaining as a premise that ink is a liquid Even if it is ink solidified less than [a room temperature or it], you may use what is softened or liquefied at a room temperature. Or by the ink-jet method, since what carries out a temperature control is common as a temperature control is performed by within the limits below 70 degreeC more than 30 degreeC for ink itself and it is in the stable regurgitation range about the viscosity of ink, ink should just make the shape of liquid at the time of use record signal grant.

[0061] In addition, in order to prevent positively by making the temperature up by heat energy use it positively as energy of the change of state from a solid state to the liquid state of ink, or in order to prevent evaporation of ink, you may use the ink which solidifies in the state of neglect and is liquefied by heating. Anyway, ink liquefies by grant according to the record signal of heat energy, and this invention can be applied when using the ink of the property liquefied for the first time by grant of heat energy, such as that by which liquefied ink is breathed out, and a thing which it already begins to solidify when reaching a record medium. In such a case, ink is good for a porosity sheet crevice or a breakthrough which is indicated by JP,54-56847,A or JP,60-71260,A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the state where it was held as a solid. In this invention, the most effective thing performs the film-boiling method mentioned above to each ink mentioned above.

[0062] Furthermore, in addition, as a gestalt of the recording device concerning this invention, although prepared in one or another object as the picture outgoing end end of information management systems, such as a computer, you may take the gestalt of the reproducing unit combined with others, the reader, etc., and the facsimile apparatus which has a transceiver function further.

[0063] In addition, even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), you may apply it to the equipments (for example, a copying machine, facsimile apparatus, etc.) which consist of one device.

[0064] Moreover, the purpose of this invention cannot be overemphasized by being attained by supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and reading and performing the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage.

[0065] In this case, the function of the operation gestalt which the program code itself read from the storage mentioned above will be realized, and the storage which memorized the program code will constitute this invention.

[0066] As a storage for supplying a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, CD-R, a magnetic tape, nonvolatile memory card, ROM, etc. can be used, for example.

[0067] Moreover, being contained when the function of the operation gestalt which performed a part or all of processing that OS (operating system) which is working on a computer is actual, based on directions of the program code, and the function of the operation gestalt mentioned above by performing the program code which the computer read is not only realized, but was mentioned above by the processing is realized cannot be overemphasized.

[0068] Furthermore, being contained, when the function of the operation gestalt which performed a part or all of processing that CPU with which the expansion board and expansion unit are equipped is actual, and was mentioned above by the processing is realized based on directions of the program code, after the program code read from the storage is written in the memory with which the expansion unit connected to the expansion board inserted in the computer or the computer is equipped cannot be overemphasized.

[0069]

[Effect of the Invention] According to this invention, at least one kind of color ink As mentioned above, the 1st record nozzle group in which the regurgitation is possible, At least two kinds of black ink in which concentration differs The 2nd record nozzle group in which the regurgitation is

possible, Moving relatively the 1st and 2nd record nozzle groups to a record medium Make this record medium breathe out ink and it has the record control means on which a color picture and a monochrome picture are made to record alternatively. By having made [more / ink / color / which] / the kind of concentration of black ink than the kind of concentration of color ink, it can record without exchanging record media by the color picture and the monochrome picture, and record of a color picture and a monochrome picture is attained at the same record medium if needed.

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to image recording equipment, its control method, and a recording device.

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PRIOR ART

[Description of the Prior Art] In recent years, the color printer recordable on a record medium has spread the color picture. However, since there are problems, like recording rate becomes slow like the after-mentioned when it is going to record monochrome pictures, such as a character, by the color printer, the color printer which used the color ink head and the black ink head properly if needed, and enabled record of a color picture and a monochrome picture at the same record medium by carrying both the color ink head for color picture record and the black ink head for binary image recording is proposed.

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EFFECT OF THE INVENTION

[Effect of the Invention] In this invention, at least one kind of color ink As mentioned above, the 1st record nozzle group in which **** is possible, At least two kinds of black ink in which concentration differs The 2nd record nozzle group in which **** is possible, Moving relatively the 1st and 2nd record nozzle groups to a record medium This record medium was made to breathe out ink, it had the record control means on which a color picture and a monochrome picture are made to record alternatively, and the kind of concentration of black ink was made [more] also about which color ink than the kind of concentration of color ink. Therefore, it can record without exchanging record media by the color picture and the monochrome picture, and record of a color picture and a monochrome picture is attained at the same record medium if needed.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, in the medical field using an X-ray photograph, an CT-MRI picture, etc., the monochrome picture is still used abundantly. the reason — the concentration of human being's eyes — since resolution is high — high concentration — in the medical field as which resolution is required, it is because there is much amount of information which the monochrome picture can recognize by the eye rather than a color picture [0004] furthermore, the concentration which rather than can recognize [which uses the record medium of a transparency formula] by human being's eyes using the record medium of a reflective formula — resolution is high and the bird clapper is known the concentration of human being's eye [as opposed to a color picture generally] — resolution is said to be 10 or 11 bits about the monochrome transparency picture to being about 8 bits

[0005] and an X-ray photograph and an CT-MRI picture are offered as a medical-application picture by recording on the record medium of a transparency formula — having — a doctor — the concentration of human being's eyes — resolution — a diagnostic result is obtained by reading a picture in a limit However, also by the picture used for the same medical field, the color picture is used abundantly in order for ultrasonic diagnosis, nuclear medicine equipment, an endoscope, an eyegrounds photography picture, a pathology microphotography, etc. to express the functional information of living bodies, such as a state of the purpose which obtains a living body's sexual desire news, or a blood flow.

[0006] Then, conventionally, the recording device for color picture record and the recording device for monochrome high gradation image recording were prepared separately, and these were used properly. For this reason, management of the picture which could not record a color picture and a monochrome high gradation picture on the same record medium, but was recorded on it was also complicated.

[0007] Moreover, although there is also a recording device for color picture record which can record a monochrome picture, there is a fault that it is inferior by gradation expression compared with the recording device only for monochrome pictures. Moreover, it needed to use properly, exchanging the record medium for color picture record, and the record medium for monochrome image recording according to a use, respectively.

[0008] As an example of such a recording device, there is a thing of a sublimated type hot printing method. This prepares three kinds of ink ribbons (color) of Y, M, C, or R, G and B, is in the state which piled up the ink ribbon and the record medium—ed, heats them partially by the thermal head, and forms a picture by imprinting through the color of an ink ribbon. A color picture can be formed by repeating the process same about three kinds of ink ribbons 3 times. What is necessary is just to pile all of three kinds of ink up equally by this method, in order to record monochrome. However, it is difficult to express the neutral monochrome which does not have a tint in three kinds of colors in order to express monochrome in piles by this method. Moreover, concentration (for example, OD3) of sufficient monochrome cannot be expressed especially to a transparency medium.

[0009] So, when you needed neutral monochrome concentration or neutral monochrome concentration deep enough, it had acquired the picture by carrying out the melanism of the portion which the medium for monochrome pictures of a sensible-heat formula was prepared

[portion] independently, was partially heated [portion] by the above-mentioned thermal head, and made it heat. That is, while exchanging the medium for color pictures, and the medium for monochrome pictures, it was what detaches and attaches an ink ribbon if needed.

[0010] Another method is an ink-jet method. In this case, three kinds of ink of Y, M, C, or R, G and B is prepared, and a color picture can be expressed by piling up three colors. When expressing monochrome also in this case, three colors can be expressed in piles equally.

However, in order to pile up three colors like a sublimated type hot printing method also in this case, it is difficult to express neutral monochrome without a tint. Moreover, although ink had to be piled up to the same pixel in order to express the concentration (for example, OD3) of sufficient monochrome especially to a transparency medium, there is a limitation in the ink absorption capacity of a medium, and sufficient monochrome concentration was not able to be expressed. That is, although the overprint of the ink is carried out to the same pixel in order to take out gradation to a picture, and in order to make concentration deep, if there is a limitation in the amount of ink absorption of a record medium-ed and it piles up exceeding this limitation, ink will overflow and a picture will bleed.

[0011] It is this invention's being made in view of an above-mentioned technical problem, being able to record the purpose, without exchanging a record medium and an ink ribbon by the color picture and the monochrome high gradation picture, and providing the same record medium with the image recording equipment which can record a color picture and the good monochrome high gradation picture of grace, its control unit, and a recording device if needed.

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MEANS

[Means for Solving the Problem] An above-mentioned technical problem is solved, and in order to attain the purpose, the image recording equipment of this invention is equipped with the following composition. At least one kind of color ink Namely, the 1st record nozzle group in which the regurgitation is possible, black ink — the 2nd record nozzle group in which the regurgitation is possible — this, moving relatively the 1st and 2nd record nozzle groups to a record medium the record control means on which make this record medium breathe out ink and a color picture and a monochrome picture are made to record alternatively — having — the kind of concentration of the aforementioned black ink — the above — it was made [more] than the kind of concentration of the color ink about which color ink

[0013] In order to solve the above-mentioned problem, in this invention, among the ink of Y, M, C, or R, G and B, the monochrome ink of the shade of many kinds is prepared, and a picture to record is divided into a monochrome field and a color field, and about a color field, it is color ink, and records in monochrome ink about a monochrome field rather than most colors of the kind of shade.

[0014] Moreover, the control method of the image recording equipment of this invention is equipped with the following features. At least one kind of color ink Namely, the 1st record nozzle group in which the regurgitation is possible, black ink — the 2nd record nozzle group in which the regurgitation is possible — this, moving relatively the 1st and 2nd record nozzle groups to a record medium Make this record medium breathe out ink and it has the record control means on which a color picture and a monochrome picture are made to record alternatively. In the image recording equipment made [more] than the kind of concentration of the color ink about which color ink the kind of concentration of the aforementioned black ink — the above — the aforementioned record control means While making a color picture and a monochrome picture higher than the concentration gradation about each monochrome of this color picture the same record medium recordable, a record section is divided and a color picture and a monochrome picture are recorded on it at the same record medium. It became possible to lessen the number of times of an overprint to the same pixel, and to express the gradation of monochrome, and high concentration by this. Moreover, the recording device of this invention is equipped with the following composition. That is, in the recording device which performs gradation record using two or more black ink in which concentration differs, and color ink, there is more gradation which can be expressed in two or more aforementioned black ink than the number of gradation which can be expressed in the aforementioned color ink.

[0015]

[Embodiments of the Invention] Below, the operation gestalt of this invention is explained in detail with reference to an accompanying drawing.

[Mechanical composition] drawing 1 is the perspective diagram showing the principal part (Records Department) of the ink-jet recording device of the operation gestalt concerning this invention, drawing 2 A is the side elevation seen from the view A of drawing 1 , and drawing 3 and drawing 4 A and drawing 4 B are the partial detail drawing of the recording head of drawing 1 .

[0016] In drawing 1 and drawing 2 A, the sheet with which 501 has a picture recorded, 502, 503

and 504, and 505 are rollers which become a pair and convey a sheet in the direction of X, respectively. The diameter expansion section 506 is formed in a longitudinal direction at intervals of predetermined, and, as for a roller 505, the diameter expansion section 506 contacts a sheet. It is the pulley with which 507 was attached in the motor and 508 was attached in the motor shaft, and the pulley with which 509 and 510 were attached in the end of rollers 502 and 504, and is combined with the pulley 508 with the belt 511, and rollers 502 and 504 rotate by rotation of a motor. Moreover, by energization means by which it does not illustrate, rollers 503 and 505 are energized in the direction which presses rollers 502 and 504, respectively, put a sheet with each roller, and convey it in the direction of X.

[0017] 512 is the carriage which carries two or more heads 513a-513l., and as shown in each head at drawing 4 A, it is prepared in the position where many nozzles counter a sheet side. 516 and 517 are the shafts held possible [sliding of carriage], and 516 has the structure where the height 519 which penetrated the hole 518 prepared in carriage, and was installed by carriage 512 contacts on a shaft 517.

[0018] It is arranged so that the field in which the nozzle of a head 513 was prepared may counter a sheet at intervals of [d] predetermined by the above composition. 520 is the belt fixed to carriage 512 in the part, and has combined between the pulleys 524 attached in the pulley 522 and the fixed shaft 523 which were attached in the driving shaft of a motor 521 possible [rotation].

[0019] By the above composition, both-way movement of carriage is attained along the direction of Y by rotation of a motor 521, and it becomes movable to position-in-readiness 512a and a symmetric position about position-in-readiness 512a and the sheet of the direction whole region of Y of a sheet, and carriage. In addition, while moving in a sheet top, the interval d of a nozzle side and a sheet is constituted so that it may be held uniformly. 526a-526l., it is the ink cartridge which put in ink, and Heads 513a-513l. are equipped, and ink is supplied to a head. A head cartridge 526 can supply ink by removing and attaching a new ink cartridge, if attachment and detachment are free and the ink of an ink cartridge is lost to a head 513.

[0020] 12 kinds of ink cartridges are prepared. The items are six kinds from which concentration differs in two kinds of cyano shades, two kinds of Magenta shades, two kinds of yellow shades, and black ink in an order from 526a. The 2nd nozzle group for black ink which has six nozzle groups (513g-513l.), and the 2nd nozzle group for color ink which has six nozzle groups (513a-513f) correspond to the kind of this ink cartridge. In addition, it is good in an order from 526a also as that from which concentration differs in two kinds of red shades, two kinds of green shades, two kinds of blue shades, and black ink instead of using these ink. Heads 523a-523l. can be equipped with these different cartridges, respectively. 525 is the sheet guide prepared between a roller 502 and 504, and the relief of a sheet is prevented because attract a sheet by air toward the lower part of drawing 2 A with a suction means by which it does not illustrate and a sheet sticks to a sheet guide with the suction force from the stoma of a large number prepared in the field which touches a sheet. If a sheet comes floating, it becomes impossible to hold an interval d naturally, and a sheet may collide with a head. 515 is a dot formed on a sheet, when ink is breathed out on a sheet from a nozzle.

[0021] In addition, although constituted from a separate head for every color, two or more colors or the head of concentration is really considered as composition, the inside of one head is divided into two or more nozzle groups, and you may make it assign a color or concentration for every nozzle group in this example.

[Electrical circuit composition] drawing 5 is the block diagram of the control circuit which manages various control of the ink-jet recording device of this operation form.

[0022] As shown in drawing 5, as for 1, image data is inputted through an external instrument or a network in the picture input sections, such as a scanner. It is the picture field separation section, 1' divides into a monochrome picture field and a color picture field the image data inputted into the picture input section 1, and about each field, if it is a monochrome picture field and it is the concentration data and the color picture field to each pixel, it will obtain the concentration data to each pixel about each color whose color was separated into cyanogen, a Magenta, yellow or red, green, and three blue colors. A control unit equipped with the various

keys 2 instructs a setup and printing start of various parameters to be, and 3 are CPUs which control this whole recording device according to the various programs in a storage.

[0023] 4 is a storage which stores the program for operating this recording device according to a control program or an error-processing program etc. All operation of this operation form is operation by this program. As a record medium 4 which stores this program, ROM, FD, CD-ROM, HD, memory card, a magneto-optic disk, etc. can be used.

[0024] The ink kind distribution table (ink kind combination table) for referring to the gamma correction translation table for referring to 4a by gamma transform processing in a storage 4 and 4b by processing of below-mentioned ink kind distribution and 4d of program groups which store various programs are shown, respectively.

[0025] 5 is RAM used as the work area of the various programs in a storage 4, the momentary shunting area at the time of error processing, and a work area at the time of an image processing. Moreover, RAM5 can also advance an image processing, changing the contents of the table after copying the various tables in a record medium 4, and referring to this changed table.

[0026] 6 is the image-processing section which creates the **** pattern for realizing high gradation by the ink jet based on an input picture.

[0027] 7 is a printer which forms a dot picture based on the **** pattern created in the image-processing section at the time of record, and includes the Records Department which showed drawing 1. 8 is a bus line which transmits the address signal in this equipment, data, a control signal, etc.

The image-processing section 6 is explained with reference to the [image-processing section], next drawing 6.

[0028] The gamma correction processing 11 is changed into the signal CD with which concentration is expressed using gamma correction translation table 4a prepared about monochrome and color each color, respectively in the picture signal valve flow coefficient inputted in the picture input section 1, and is stored in the page memory field of the image-processing work area of RAM5. With this operation form, the monochrome picture makes the level division of CD value 8 bits about 12 bits and color each color, respectively.

[0029] The attention pixel selection 12 chooses from this in a page memory field 1 pixel which is going to carry out processing, and obtains the concentration data CD.

[0030] In the ink kind distribution processing 13, the combination of the ink kind which expresses the concentration near the concentration CD of an attention pixel with reference to ink kind distribution table 4b based on CD value of an attention pixel is chosen. In the concentration error calculation 15, the difference of the concentration and CD value of an attention pixel which can be expressed in the combination of the ink chosen by the ink kind distribution processing 13 is computed. this combination — also being based — the binary signals d1, d2, and d3 of the regurgitation of the head of each concentration and the non-regurgitation and — are determined

[0031] the error diffusion process 16 — the above — difference is distributed to the pixel of the circumference which has not yet carried out ink kind distribution processing by the predetermined method, and addition or subtraction is carried out to CD value of an applicable pixel

[0032] The observed 1-pixel processing is completed by performing the above processing.

[0033] Here, ink kind distribution table 4b is explained. The ink to be used, the concentration information at the time of recording, etc. are recorded on ink kind distribution table 4b about the kind and concentration of ink, and an operating combination and its concentration information on an operating combination and the concentration information on the shade ink of CMY each color as shown below, and the shade ink to the black in an achromatic locus are included in it in this operation form. To CMY, it is a total of six kinds and six kinds of *****, and shade ink is indicated to be 1, 2, and 3 — by the suffix sequentially from the one where concentration is higher. The rate of the color ratio of concentration of these ink is shown in Table 1. Table 1 shows the color ratio of concentration and reflection density of various ink. In addition, ink consists of a color and a solvent and various additives, such as a surfactant and moisturization

material, are contained in the solvent. These additives control the **** property from a head, and the absorption property in the television paper.

[0034]

[Table 1]

	C1	C2	M1	M2	Y1	Y2
染料濃度 比率 (%)	3.5%	0.9%	3.5%	0.9%	3.5%	0.9%
反射濃度 (O.D.)	1.88	0.51	1.58	0.59	1.58	0.59

	K1	K2	K3	K4	K5	K6
染料濃度 比率 (%)	4.8%	2.4%	1.2%	0.6%	0.3%	0.15%
反射濃度 (O.D.)	1.67	0.86	0.51	0.27	0.13	0.07

[0035] Using these ink, to CMY, 1 pixel is formed by a maximum of two ink dots, and 1 pixel is formed by a maximum of four ink dots in an achromatic locus to K. This result is shown in drawing 2 B and drawing 2 C. The number in drawing shows the number of the ** ink dots breathed out to one pixel, and zero breathe out and twist the ink and show things. Moreover, the column of concentration level shows the value made to correspond to a 8-bit input picture signal (for 0-255:0 to be the highest concentration) by CMY. That is, multiple-value-ized processing of five values will be performed about CMY, and multiple-value-ized processing of 43 values will be performed by the achromatic locus about K corresponding to a 12-bit input picture signal (zero to 4095:0 is the highest concentration). As mentioned above, the table on which the ink of each color when recording in chromatic color (Y, M, C) ink in this operation form, as shown by drawing 2 B can respond to five concentration level is prepared. When recording in achromatic color (BK) ink, the table which can respond to more concentration level of 42 than the concentration level (the number of gradation expression) of chromatic color (Y, M, C) ink as shown by drawing 2 C is prepared. In recording, it records by choosing the combination of the ink kind corresponding to the gradation value which should be recorded, respectively. the attention pixel selection 12 of the above-mentioned based on the concentration data CD of a picture, and processing of the ink kind distribution processing 13 — all pixels — the binary signals d1, d2, and d3 of **** for every

pixel to each head with different concentration and non-**** and — are formed by repeating a number. The above processing is performed one by one about each color of a monochrome picture and a color picture using each ink kind distribution table. In addition, the image-processing section is prepared about monochrome and each color, respectively, and it is parallel and you may process.

[0036] When recording, a sheet 501 is sent in among rollers 502 and 503 from the left of drawing by means by which it does not illustrate, by drawing 2 A. Subsequently, a sheet is sent to a predetermined distance [every] intermittent target in the direction of X by the motor 507. While the sheet has stopped, a motor 521 rotates and carriage is moved in the direction of Y at a fixed speed. While the head on carriage passes through a sheet top, the nozzle **** command signal corresponding to the picture signal is sent by the control circuit of drawing 5 and drawing 6 , and a drop is alternatively breathed out from each nozzle according to this. While being in the position distant from on the sheet, a motor 507 moves a sheet in the direction of predetermined distance X, and stops, and a motor 507 moves a sheet at predetermined speed, and makes a drop for a head to pass through a sheet top and breathe out alternatively similarly again here. Finally by repeating this below, a desired picture is recorded on a sheet. The sheet which record ended is conveyed leftward [of drawing 2 A] in 504 and 506, and, subsequently to the left of drawing 2 A, is discharged with a conveyance means by which it does not illustrate.

[0037] The example of record by this recording device is shown in drawing 7 . As for an X-ray picture and 532, 531 is [CT picture and 533] MRI pictures, and gradation expression of each of these is carried out by 12 bits by the monochrome picture. 534 is an endoscope picture, 535 is a fundus-of-the-eye picture, these two are a color picture and gradation expression is carried out in each color of 8 bits. Thus, if the same patient's picture is collectively recorded on the sheet of one sheet, correspondence is easy and convenient.

[0038] Drawing 8 is the example of record of another picture. Although 537 is a color Doppler ultrasonic wave picture and most is a monochrome high gradation picture, only Kurobe 538 serves as a color picture and is expressing the state of a blood flow according to a color.

[0039] Thus, the algorithm which carries out high gradation record using three or more kinds of black shade ink is indicated by Japanese Patent Application No. No. 78423 [nine to], for example. Moreover, the algorithm which records a color picture using the color ink of two kinds of shades is indicated by JP,6-226998,A. What is necessary is just to record with each algorithm to each field, when dividing a field and recording a monochrome picture and a color picture.

[Image recording equipment of 2nd operation gestalt] <=?6=:///&N0001=511&N0552=9&N0553=000015"

TARGET="tjitemdrw"> drawing 9 shows the image recording equipment of the 2nd operation gestalt.

[0040] The same component as drawing 1 is omitting in drawing 9 .

[0041] In drawing 9 , reserve tanks 540a-540l. are attached in the head 513, and the ink of a constant rate is accumulated at it. Every one tube 541 each is connected from reserve tanks 540a-540l., and this tube is connected with the ink tanks 544a-544l. which correspond via the pump meanses 545a-545l., respectively, and if the amount of ink of a reserve tank decreases, it will supply ink to a reserve tank from an ink tank by the pump means. When the ink tank is constituted by equipment removable where it was removable in the tube and a tube is removed according to the attachment-and-detachment mechanism in which it does not illustrate, and an ink tank becomes empty, a tube is extracted, an ink tank is exchanged for a new thing, and ink is supplied by equipping with a tube again. The kind of ink is the same as the 1st operation gestalt. A tube is packed into the tube bunch 542 and pars intermedia is fixed by the tube holddown member 543. Between the reserve tank and the tube holddown member, in case it has ridden on the tube guide 546 and carriage moves, movement of on a tube guide of a tube bunch is attained so that movement of carriage may not be barred.

[0042] Although it is the same as that of the 1st operation gestalt about record operation, since there is much more capacity of an ink tank than the capacity of an ink cartridge, in recording in large quantities, compared with the frequency of exchange of an ink cartridge, the exchange frequency of an ink tank is low and its frequency of ink supply decreases.

[Image recording equipment of 3rd operation gestalt] drawing 10 shows the image recording equipment of the 3rd operation gestalt. In drawing 10, the same component as drawing 1 and drawing 9 is omitting.

[0043] In drawing 10, ink cartridges 526a-526f are attached in Heads 513a-513f like drawing 1, and reserve tanks 540g-540l are attached in Heads 513g-513l like drawing 9. One tube is connected to a reserve tank like drawing 9, respectively, and it connects with the ink tanks 544g-544l via the pump meanses 545g-545l. And about Heads 513a-513f, ink is supplied by exchanging ink cartridges, and ink is supplied by exchanging the ink tanks 544g-544l, about Heads 513g-513l. This decreases from the case where the number of the tube of ink, an ink tank, and pumps is drawing 9, and equipment is simplified. On the other hand, although the time and effort of ink cartridge exchange increases from the case of drawing 9 about Heads 513a-513f, since there are few color fields by the reason for explaining below when usually recording a picture like drawing 7 or drawing 8, there is little trouble.

[0044] That is, as for the picture of which monochrome high gradation, such as an X-ray picture and CT-MRI, is required, a sheet also usually has a large inclination. For example, as for a color picture, A4 size is used well, and, as for monochrome high gradation ****, cutting-into-half size (35x43cm) is used well. Moreover, a monochrome high gradation picture records the highest concentration for example, on about 3.0 OD value in many cases deeply.

[0045] As mentioned above, in using image recording equipment for a medical-application picture, there is the feature that it is remarkable and much consumption of black ink is compared with the consumption of color ink. Therefore, relatively, about color ink with little amount used, even if it supplies by the cartridge, exchange frequency does not increase so much. That is, the time and effort of the ink supply also as composition of drawing 10 seldom increases, but can also simplify equipment.

[Other operation gestalten] There is especially no limit about the method of an ink jet. Although this example described the example which uses the ink of a liquid, you may melt and carry out the regurgitation of the solid ink. In this case, supply of ink will exchange solid ink.

[0046] The size of a sheet is not restricted to one kind. Especially, by the monochrome pixel and the color picture, since the sizes of the sheet used by preference differ, the merit of this invention increases by the ability of two or more sheets to be used.

[0047] a sheet — reflection and transparency — any are sufficient By the medical-application picture, since a transparency sheet uses a reflective sheet for a color picture and a monochrome picture, being fond, that a reflective sheet or a transparency sheet can also be used increases the merit of this invention.

[0048] The method which records while send a sheet to an intermission, it does not remain in this operation gestalt which is made to move a head in the direction which intersects perpendicularly with a sheet feed direction, and is recorded on it while the sheet has stopped, but a sheet is sent by fixed speed, the line-like fixed head is prepared so that sheet width of face may be covered in the direction which intersects perpendicularly with the feed direction of a sheet, and a sheet is sent by fixed speed may be used. In this case, it equips with the head of the length which covers the width of face of a sheet about the becoming ink, alias each.

[0049] Although black ink was made into the tube supply method and color ink was made into the cartridge type with the 3rd operation gestalt, some black ink is sufficient as a tube supply method. In this case, it is appropriate to make ink with much amount used into a tube method. In the case of a medical-application picture, since a background is recorded in many cases by the highest concentration, there is an inclination with much [deep black ink] amount used. Then, it is possible to consider deep black ink as tube supply. Moreover, conversely, color ink is made into a tube supply method, a cartridge type, then a color picture are mainly used in black ink, and the monochrome picture is suitable when operating frequency is low.

[0050] You may accept and constitute a part of color ink. For example, what is necessary is for there to be also no full color need and to be able to use only some color ink, when it is said that the notes which do not record the living body picture of medical application, but attach an accent to a monochrome picture and which put a mark in a color for stratification are filled in.

[0051] Moreover, the picture signal of the monochrome field of the picture of not only when

separating into a monochrome field and a color field from the picture in which the monochrome field of one sheet and a color field are included, but one sheet, and the picture signal of a color field may be received separately, and you may record on the medium of one sheet. Moreover, the monochrome picture of two or more sheets and a color picture may be received, and a field may be divided and recorded on the medium of one sheet.

[0052] Especially the gestalt of the above operation is equipped with meanses (for example, an electric thermal-conversion object, a laser beam, etc.) to generate heat energy as energy used also in an ink-jet recording method in order to make the ink regurgitation perform, and can attain the densification of record, and highly minute-ization by using the method which makes the change of state of ink occur with the aforementioned heat energy.

[0053] About the typical composition and typical principle, what is performed using the fundamental principle currently indicated by the U.S. Pat. No. 4723129 specification and the 4740796 specification, for example is desirable. Although this method is applicable to both the so-called on-demand type and a continuous system On the electric thermal-conversion object which is especially arranged corresponding to the sheet and liquid route where the liquid (ink) is held in the on-demand type case By impressing at least one driving signal which gives the rapid temperature rise which corresponds to recording information and exceeds film boiling Since make an electric thermal-conversion object generate heat energy, the heat operating surface of a recording head is made to produce film boiling and the foam in the liquid (ink) corresponding to this driving signal can be formed by 1 to 1 as a result, it is effective. A liquid (ink) is made to breathe out through opening for regurgitation by growth of this foam, and contraction, and at least one drop is formed. If the shape of a pulse form is carried out, since growth contraction of a foam will be appropriately performed instance in this driving signal, the regurgitation of a liquid (ink) excellent in especially responsibility can be attained, and it is more desirable.

[0054] As a driving signal of the shape of this pulse form, what is indicated by the U.S. Pat. No. 4463359 specification and the 4345262 specification is suitable. In addition, if the conditions indicated by the U.S. Pat. No. 4313124 specification of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, further excellent record can be performed.

[0055] The composition using the U.S. Pat. No. 4558333 specification and U.S. Pat. No. 4459600 specification which indicate the composition arranged to a delivery which is indicated by each above-mentioned specification as composition of a recording head, the liquid route, and the field to which the heat operating surface other than the combination composition (a straight-line-like liquid flow channel or right-angled liquid flow channel) of an electric thermal-conversion object is crooked is also included in this invention. In addition, it is good also as composition based on JP,59-138461,A which indicates the composition whose opening which absorbs the pressure wave of JP,59-123670,A which indicates the composition which makes a common slot the regurgitation section of an electric thermal-conversion object to two or more electric thermal-conversion objects, or heat energy is made to correspond to the regurgitation section.

[0056] Furthermore, any of the composition which fills the length with the combination of two or more recording heads which are indicated by the specification mentioned above as a recording head of the full line type which has the length corresponding to the width of face of the maximum record medium which can record a recording device, and the composition as one recording head formed in one are sufficient.

[0057] In addition, the composition of the recording head of the cartridge type with which the ink tank was formed in the recording head itself in one as the composition explained with the gestalt of the above-mentioned operation and different composition may be used, and the electric connection with the main part of equipment and supply of the ink from the main part of equipment may use the recording head of the exchangeable chip type which becomes possible by not only this but the main part of equipment being equipped.

[0058] Moreover, since record operation is further made to stability, it is desirable to add the recovery means against a recording head, a preliminary means, etc. to the composition of the recording device explained above. If these are mentioned concretely, there is a preheating means by the capping means, the cleaning means, the pressurization or the suction means, the electric

thermal-conversion object, the heating elements different from this, or such combination over a recording head etc. Moreover, it is effective in order to perform record stabilized by having the reserve regurgitation mode in which the regurgitation different from record is performed.

[0059] Furthermore, by constituting a recording head in one, even with two or more combination, although it is good, it can also consider as equipment equipped with full color at least one by the double color color of a different color, or color mixture.

[0060] In the gestalt of the operation explained above, although it is explaining as a premise that ink is a liquid Even if it is ink solidified less than [a room temperature or it], you may use what is softened or liquefied at a room temperature. Or by the ink-jet method, since what carries out a temperature control is common as a temperature control is performed by within the limits below 70 degreeC more than 30 degreeC for ink itself and it is in the stable regurgitation range about the viscosity of ink, ink should just make the shape of liquid at the time of use record signal grant.

[0061] In addition, in order to prevent positively by making the temperature up by heat energy use it positively as energy of the change of state from a solid state to the liquid state of ink, or in order to prevent evaporation of ink, you may use the ink which solidifies in the state of neglect and is liquefied by heating. Anyway, ink liquefies by grant according to the record signal of heat energy, and this invention can be applied when using the ink of the property liquefied for the first time by grant of heat energy, such as that by which liquefied ink is breathed out, and a thing which it already begins to solidify when reaching a record medium. In such a case, ink is good for a porosity sheet crevice or a breakthrough which is indicated by JP,54-56847,A or JP,60-71260,A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the state where it was held as a solid. In this invention, the most effective thing performs the film-boiling method mentioned above to each ink mentioned above.

[0062] Furthermore, in addition, as a gestalt of the recording device concerning this invention, although prepared in one or another object as the picture outgoing end end of information management systems, such as a computer, you may take the gestalt of the reproducing unit combined with others, the reader, etc., and the facsimile apparatus which has a transceiver function further.

[0063] In addition, even if it applies this invention to the system which consists of two or more devices (for example, a host computer, an interface device, a reader, a printer, etc.), you may apply it to the equipments (for example, a copying machine, facsimile apparatus, etc.) which consist of one device.

[0064] Moreover, the purpose of this invention cannot be overemphasized by being attained by supplying the storage which recorded the program code of the software which realizes the function of the operation gestalt mentioned above to a system or equipment, and reading and performing the program code with which the computer (or CPU and MPU) of the system or equipment was stored in the storage.

[0065] In this case, the function of the operation gestalt which the program code itself read from the storage mentioned above will be realized, and the storage which memorized the program code will constitute this invention.

[0066] As a storage for supplying a program code, a floppy disk, a hard disk, an optical disk, a magneto-optic disk, CD-ROM, CD-R, a magnetic tape, nonvolatile memory card, ROM, etc. can be used, for example.

[0067] Moreover, being contained when the function of the operation gestalt which performed a part or all of processing that OS (operating system) which is working on a computer is actual, based on directions of the program code, and the function of the operation gestalt mentioned above by performing the program code which the computer read is not only realized, but was mentioned above by the processing is realized cannot be overemphasized.

[0068] Furthermore, being contained, when the function of the operation gestalt which performed a part or all of processing that CPU with which the expansion board and expansion unit are equipped is actual, and was mentioned above by the processing is realized based on directions of the program code, after the program code read from the storage is written in the memory with which the expansion unit connected to the expansion board inserted in the computer or the

computer is equipped cannot be overemphasized.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective diagram showing the principal part of the ink-jet recording device of this operation gestalt.

[Drawing 2 A] It is the side elevation of the view A of drawing 1.

[Drawing 2 B] It is drawing showing the table corresponding to the concentration level of each color ink in the case of recording in chromatic color ink.

[Drawing 2 C] It is drawing showing the table corresponding to the concentration level of the ink in the case of recording in colorless ink.

[Drawing 3] It is the partial detail drawing of drawing 1.

[Drawing 4 A] It is the partial detail drawing of drawing 1.

[Drawing 4 B] It is the partial detail drawing of drawing 1.

[Drawing 5] It is the control-block view of the ink-jet recording device of this operation gestalt.

[Drawing 6] It is the block diagram of the image-processing section.

[Drawing 7] It is drawing showing the example of record of a picture.

[Drawing 8] It is drawing showing the example of record of a picture.

[Drawing 9] It is drawing showing the ink-jet recording device of the 2nd operation gestalt.

[Drawing 10] It is drawing showing the ink-jet recording device of the 3rd operation gestalt.

[Description of Notations]

1 Picture Input Section

1' Picture field separation section

2 Control Unit

3 CPU

4 Storage

5 RAM

6 Image-Processing Section

501 Sheet

512 Carriage

513a-513l. Head

514 Nozzle

526a-526l. Ink cartridge

531-538 Example of record of a picture

540a-540l. Reserve tank

541 Tube

545 Pump Means

544 Ink Tank

[Translation done.]

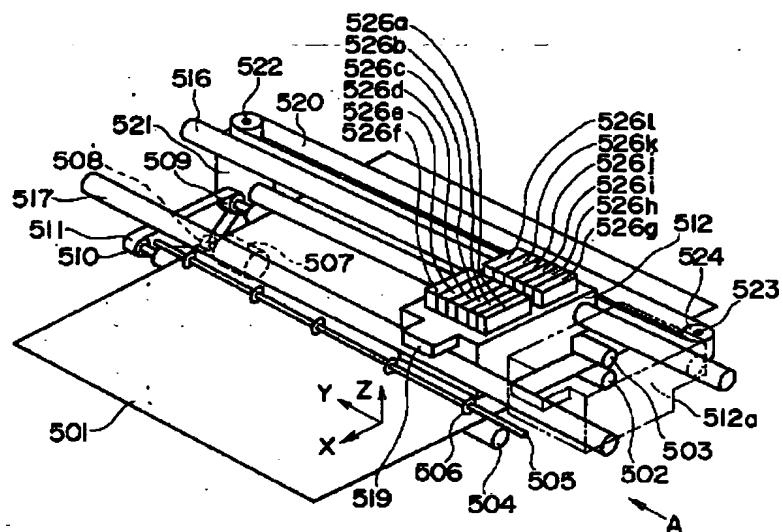
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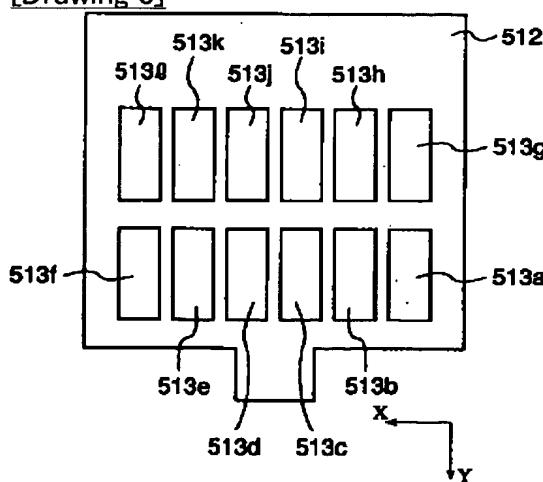
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DRAWINGS

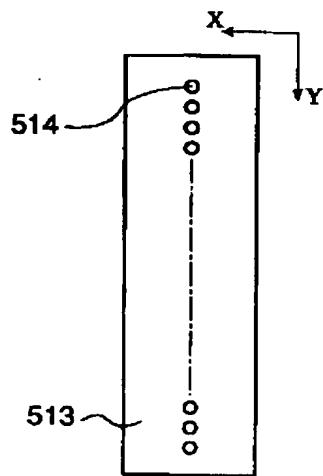
[Drawing 1]



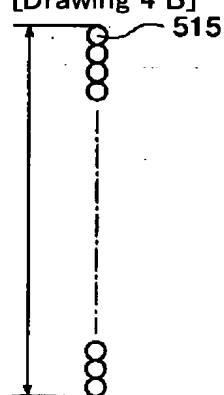
[Drawing 3]



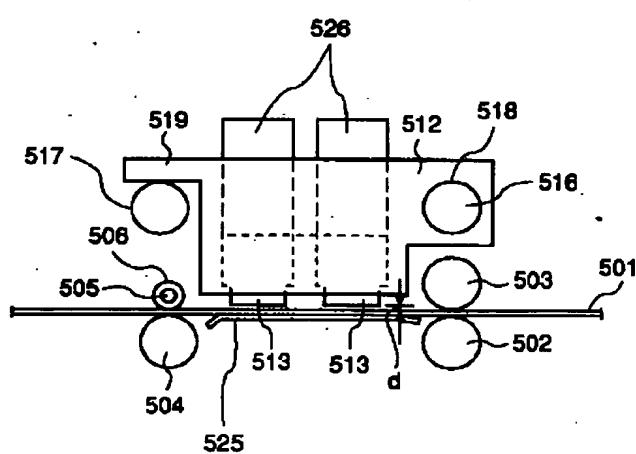
[Drawing 4 A]



[Drawing 4 A]



[Drawing 4 B]



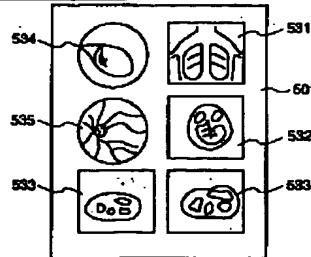
[Drawing 2 A]

No.	C1	C2	染料量	ドット数	反射濃度	濃度レベル dl [x]	th[x]
0	2	0	7.00	2	2.51	0	
1	1	0	3.50	1	1.88	66	33
2	0	2	1.80	2	0.90	164	115
3	0	1	0.90	1	0.51	204	184
4	0	0	0.00	0	0.00	255	229
No.	M1	M2	染料量	ドット数	反射濃度	濃度レベル dl [x]	th[x]
0	2	0	7.00	2	2.38	0	
1	1	0	3.50	1	1.58	86	43
2	0	2	1.80	2	0.86	163	124
3	0	1	0.90	1	0.49	203	183
4	0	0	0.00	0	0.00	255	229
No.	Y1	Y2	染料量	ドット数	反射濃度	濃度レベル dl [x]	th[x]
0	2	0	7.00	2	2.38	0	
1	1	0	3.50	1	1.58	86	43
2	0	2	1.80	2	0.86	163	124
3	0	1	0.90	1	0.49	203	183
4	0	0	0.00	0	0.00	255	229

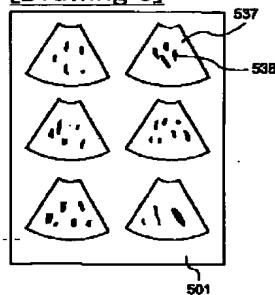
[Drawing 2 C]

No.	K1	K2	K3	K4	K5	K6	染料量	ドット数	反射濃度	濃度レベル dl [x]	th[x]
0	3	0	0	0	0	0	14.40	3	2.53	0	0
1	1	1	2	0	0	0	9.60	4	2.39	224	112
2	1	1	1	0	0	1	8.55	4	2.30	368	288
3	1	1	0	1	0	0	7.80	3	2.22	512	432
4	1	1	0	0	0	1	7.35	3	2.16	608	560
5	1	0	1	1	0	0	6.90	4	2.09	704	656
6	1	0	1	0	1	1	6.45	4	2.01	832	768
7	0	2	1	0	0	0	6.00	3	1.93	960	896
8	0	2	0	1	1	0	5.70	4	1.87	1056	1008
9	0	1	2	1	0	0	5.40	4	1.81	1168	1120
10	0	1	2	0	1	0	5.10	4	1.74	1280	1216
11	0	1	1	2	0	0	4.80	4	1.67	1392	1328
12	0	1	1	1	1	0	4.50	4	1.60	1504	1440
13	0	1	1	1	0	1	4.35	4	1.56	1568	1536
14	0	1	1	1	0	0	4.20	3	1.52	1632	1600
15	0	1	1	0	1	1	4.05	4	1.48	1696	1664
16	0	1	1	0	1	0	3.90	3	1.43	1760	1728
17	0	1	1	0	0	1	3.75	3	1.39	1840	1808
18	0	1	0	1	2	0	3.60	4	1.35	1904	1872
19	0	1	0	1	1	1	3.45	4	1.30	1984	1936
20	0	1	0	1	1	0	3.30	3	1.26	2048	2016
21	0	0	2	1	0	1	3.15	4	1.21	2128	2096
22	0	0	2	1	0	0	3.00	3	1.16	2208	2160
23	0	0	2	0	1	1	2.85	4	1.12	2288	2240
24	0	0	1	2	1	0	2.70	4	1.07	2368	2320
25	0	0	1	2	0	1	2.55	4	1.02	2448	2400
26	0	0	1	1	2	0	2.40	4	0.96	2528	2480
27	0	0	1	1	1	1	2.25	4	0.91	2608	2576
28	0	0	1	1	1	0	2.10	3	0.86	2704	2656
29	0	0	1	1	0	1	1.95	3	0.80	2784	2736
30	0	0	1	1	0	0	1.80	2	0.75	2880	2832
31	0	0	1	0	1	1	1.65	3	0.69	2960	2928
32	0	0	0	2	0	2	1.50	4	0.63	3056	3008
33	0	0	0	1	2	1	1.35	4	0.57	3152	3104
34	0	0	0	1	1	2	1.20	4	0.51	3248	3200
35	0	0	0	1	1	1	1.05	3	0.45	3344	3296
36	0	0	0	1	1	0	0.90	2	0.39	3456	3392
37	0	0	0	1	0	1	0.75	2	0.33	3552	3504
38	0	0	0	0	1	2	0.60	3	0.27	3648	3600
39	0	0	0	0	1	1	0.45	2	0.20	3760	3712
40	0	0	0	0	0	2	0.30	2	0.13	3856	3808
41	0	0	0	0	0	1	0.15	1	0.07	3968	3920
42	0	0	0	0	0	0	0.00	0	0.00	4080	4032

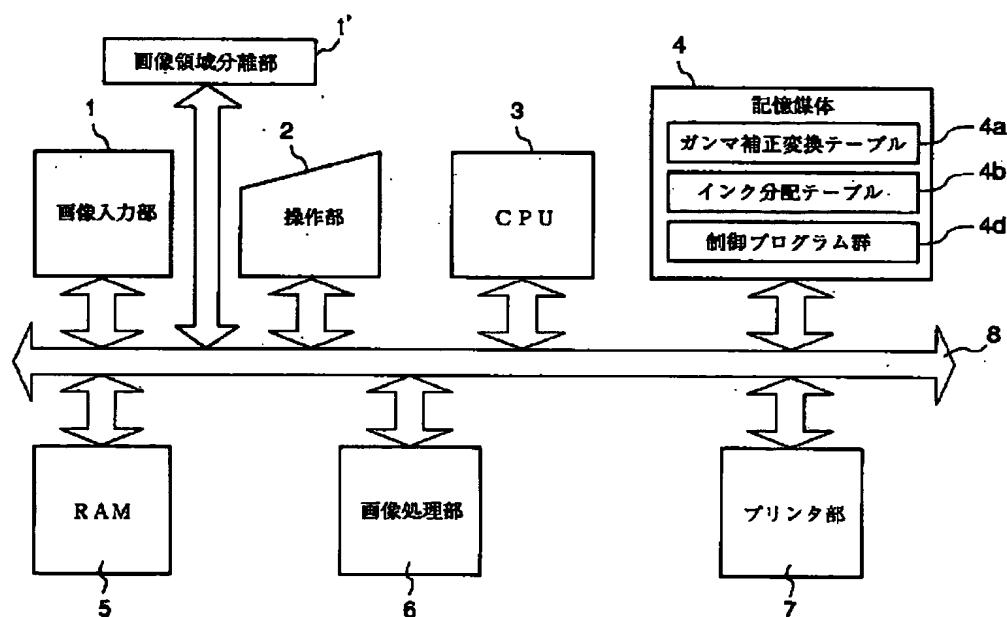
[Drawing 7]



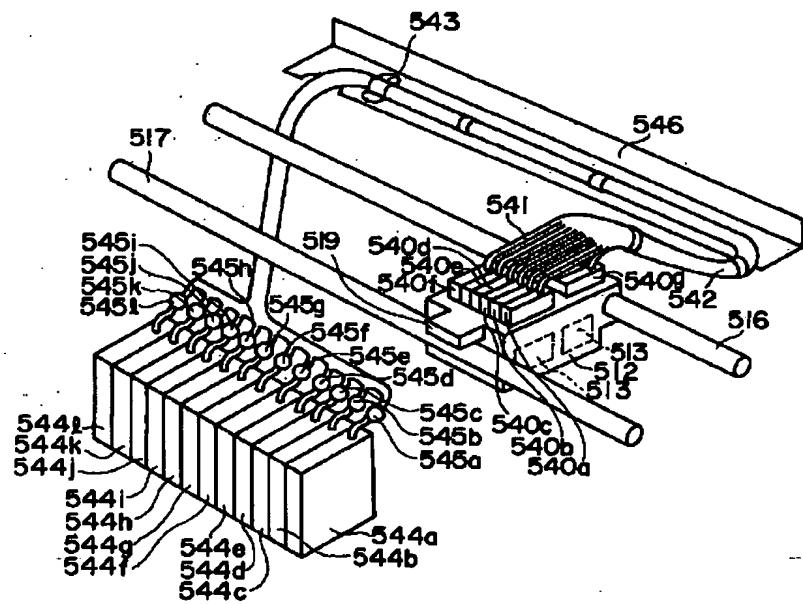
[Drawing 8]



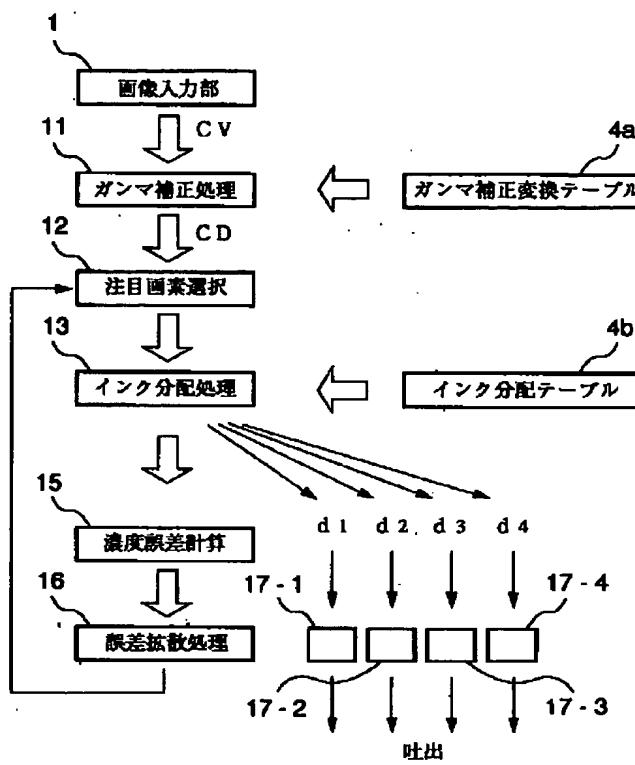
[Drawing 5]



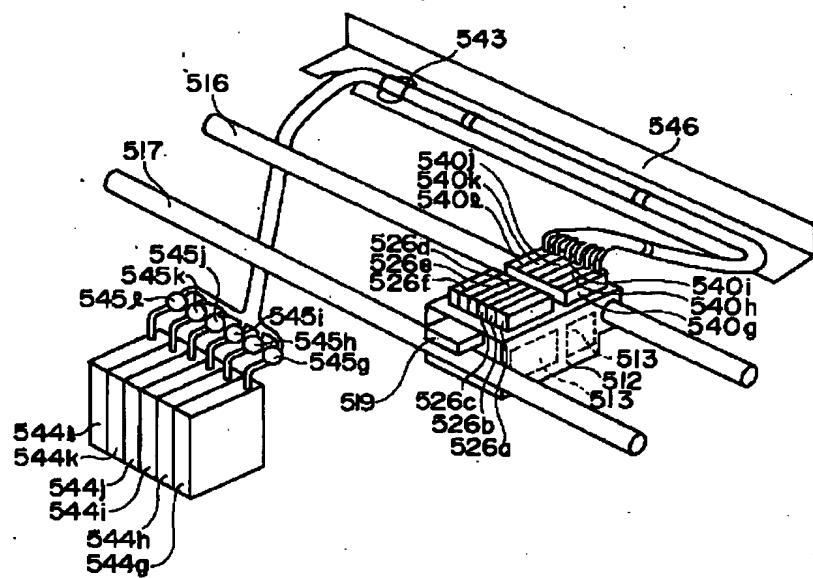
[Drawing 9]



[Drawing 6]

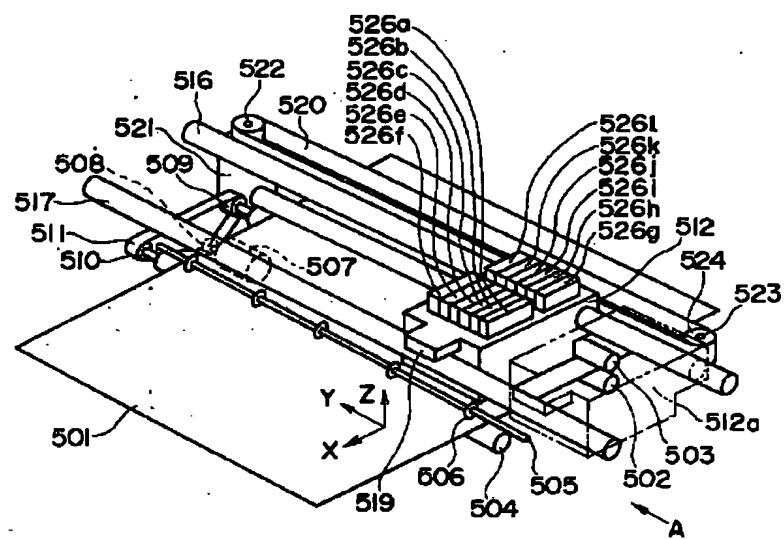


[Drawing 10]



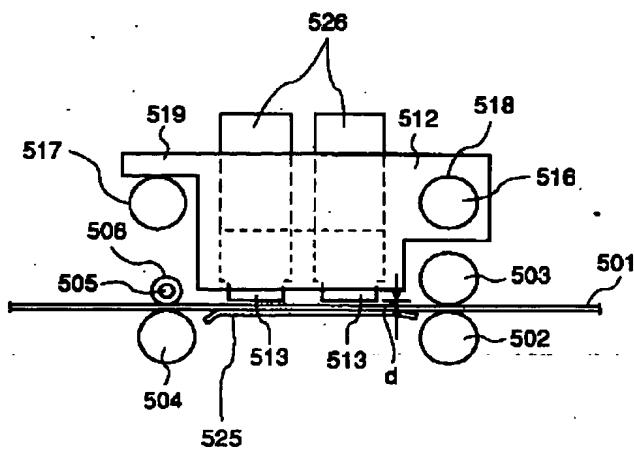
[Translation done.]

Drawing selection drawing 1



[Translation done.]

Drawing selection drawing 2 A



[Translation done.]

Drawing selection drawing 2 B

No.	C1	C2	染料量	ドット数	反射濃度	濃度レベル dl [x]	th[x]
0	2	0	7.00	2	2.51	0	
1	1	0	3.50	1	1.88	86	33
2	0	2	1.80	2	0.90	164	115
3	0	1	0.90	1	0.51	204	184
4	0	0	0.00	0	0.00	255	229

No.	M1	M2	染料量	ドット数	反射濃度	濃度レベル dl [x]	th[x]
0	2	0	7.00	2	2.38	0	
1	1	0	3.50	1	1.58	86	43
2	0	2	1.80	2	0.86	163	124
3	0	1	0.90	1	0.49	203	183
4	0	0	0.00	0	0.00	255	229

No.	Y1	Y2	染料量	ドット数	反射濃度	濃度レベル dl [x]	th[x]
0	2	0	7.00	2	2.38	0	
1	1	0	3.50	1	1.58	86	43
2	0	2	1.80	2	0.86	163	124
3	0	1	0.90	1	0.49	203	183
4	0	0	0.00	0	0.00	255	229

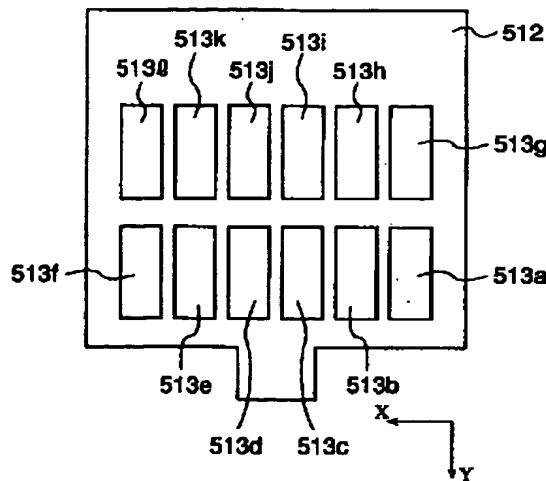
[Translation done.]

Drawing selection drawing 2 C

No.	K1	K2	K3	K4	K5	K6	染料量	ドット数	反射速度	濃度レベル dI[x]	th[x]
0	3	0	0	0	0	0	14.40	3	2.59	0	0
1	1	1	2	0	0	0	9.60	4	2.39	224	112
2	1	1	1	0	0	1	8.55	4	2.30	368	288
3	1	1	0	1	0	0	7.80	3	2.22	512	432
4	1	1	0	0	0	1	7.35	3	2.16	608	560
5	1	0	1	1	1	0	6.90	4	2.09	704	656
6	1	0	1	0	1	1	6.45	4	2.01	832	768
7	0	2	1	0	0	0	6.00	3	1.93	960	896
8	0	2	0	1	1	0	5.70	4	1.87	1058	1008
9	0	1	2	1	0	0	5.40	4	1.81	1188	1120
10	0	1	2	0	1	0	5.10	4	1.74	1280	1216
11	0	1	1	2	0	0	4.80	4	1.67	1392	1328
12	0	1	1	1	1	0	4.50	4	1.60	1504	1440
13	0	1	1	1	0	1	4.35	4	1.56	1568	1536
14	0	1	1	1	0	0	4.20	3	1.52	1632	1600
15	0	1	1	0	1	1	4.05	4	1.48	1696	1664
16	0	1	1	0	1	0	3.90	3	1.43	1760	1728
17	0	1	1	0	0	1	3.75	3	1.39	1840	1808
18	0	1	0	1	2	0	3.60	4	1.35	1904	1872
19	0	1	0	1	1	1	3.45	4	1.30	1984	1936
20	0	1	0	1	1	0	3.30	3	1.26	2048	2016
21	0	0	2	1	0	1	3.15	4	1.21	2128	2096
22	0	0	2	1	0	0	3.00	3	1.16	2208	2160
23	0	0	2	0	1	1	2.85	4	1.12	2288	2240
24	0	0	1	2	1	0	2.70	4	1.07	2368	2320
25	0	0	1	2	0	1	2.55	4	1.02	2448	2400
26	0	0	1	1	2	0	2.40	4	0.96	2528	2480
27	0	0	1	1	1	1	2.25	4	0.91	2608	2576
28	0	0	1	1	1	0	2.10	3	0.86	2704	2656
29	0	0	1	1	0	1	1.95	3	0.80	2784	2736
30	0	0	1	1	0	0	1.80	2	0.75	2880	2832
31	0	0	1	0	1	1	1.65	3	0.69	2960	2928
32	0	0	0	2	0	2	1.50	4	0.63	3056	3008
33	0	0	0	1	2	1	1.35	4	0.57	3152	3104
34	0	0	0	1	1	2	1.20	4	0.51	3248	3200
35	0	0	0	1	1	1	1.05	3	0.45	3344	3296
36	0	0	0	1	1	0	0.90	2	0.39	3456	3392
37	0	0	0	1	0	1	0.75	2	0.33	3552	3504
38	0	0	0	0	1	2	0.60	3	0.27	3648	3600
39	0	0	0	0	1	1	0.45	2	0.20	3760	3712
40	0	0	0	0	0	2	0.30	2	0.13	3856	3808
41	0	0	0	0	0	1	0.15	1	0.07	3968	3920
42	0	0	0	0	0	0	0.00	0	0.00	4080	4032

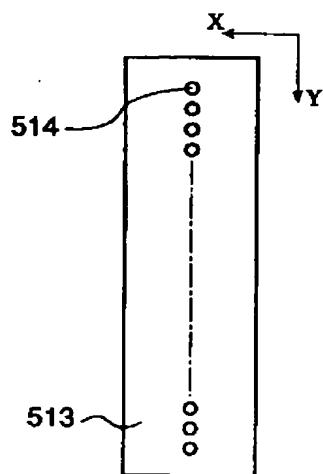
[Translation done.]

Drawing selection drawing 3



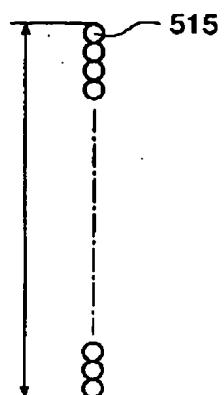
[Translation done.]

Drawing selection drawing 4 A



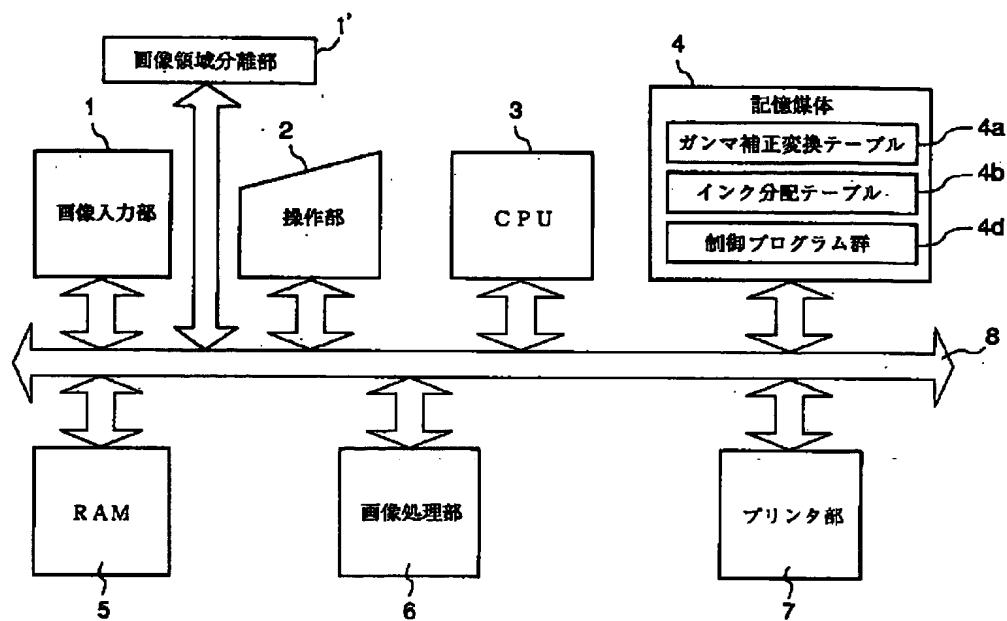
[Translation done.]

Drawing selection drawing 4 B



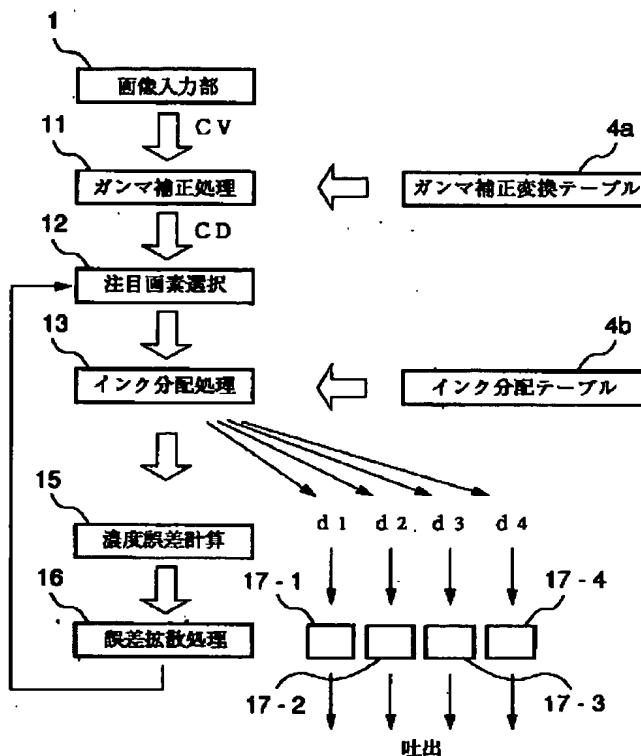
[Translation done.]

Drawing selection drawing 5

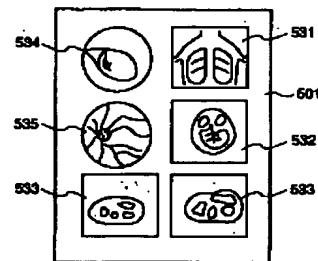


[Translation done.]

Drawing selection drawing 6

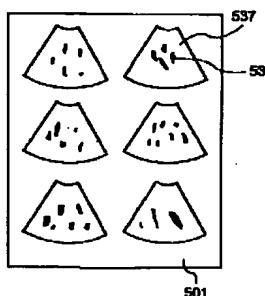


[Translation done.]

Drawing selection [drawing 7] 

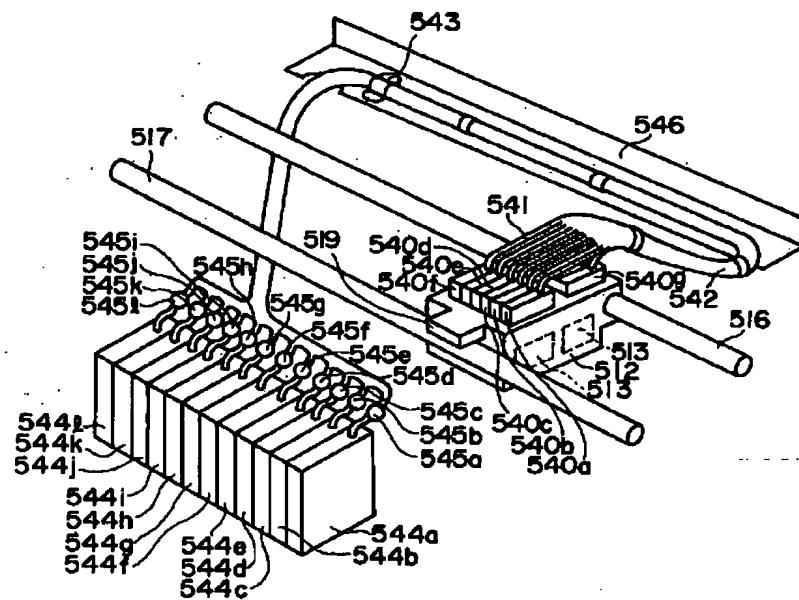
[Translation done.]

Drawing selection drawing 8



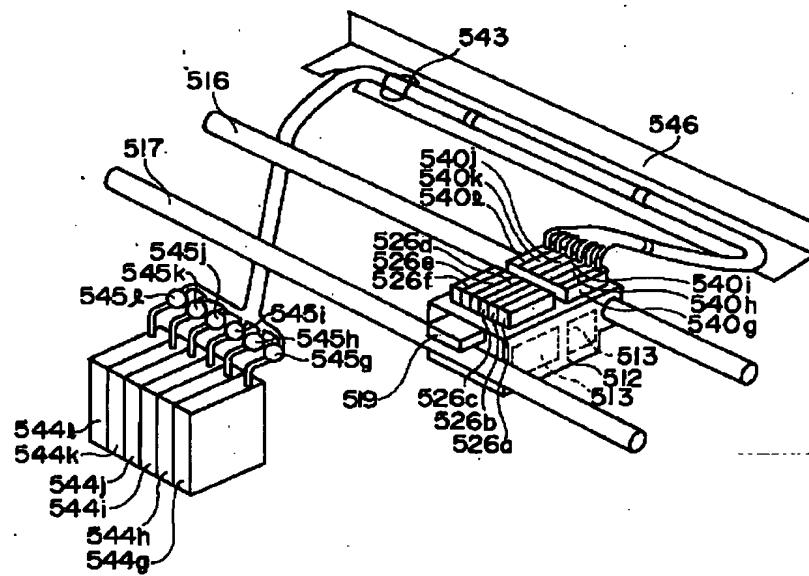
[Translation done.]

Drawing selection drawing 9



[Translation done.]

Drawing selection drawing 10



[Translation done.]

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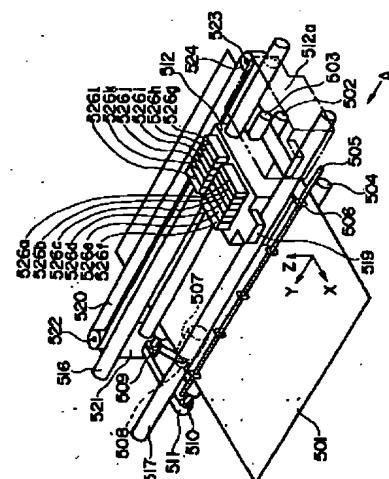
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(32)優先日 平10(1998)3月13日

(33)優先権主張国 日本 (JP)

(54)【発明の名称】 画像記録装置及びその制御方法並びに記録装置

(57)【要約】

【課題】同一の記録媒体にカラー画像とモノクロ高階調
画像を記録する。【解決手段】少なくとも1種類のカラーインクを吐出可能
なカラー記録ヘッド513a～513fと、モノクロ
インクを吐出可能なモノクロ記録ヘッド513g～51
3lと、これら記録ヘッドをシートに対して相対的に移
動させつつ、このシートにインクを吐出させて、カラー
画像とモノクロ画像とを選択的に記録させる記録制御部
とを備え、モノクロインクの濃度の種類をカラーインク
の濃度の種類よりも多くした。

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【特許請求の範囲】

【請求項 1】 少なくとも 1 種類のカラーインクを吐出可能な第 1 の記録ノズル群と、黒色インクを吐出可能な第 2 の記録ノズル群と、該第 1 及び第 2 の記録ノズル群を記録媒体に対して相対的に移動させて、該記録媒体にインクを吐出させることで、カラー画像とモノクロ画像とを選択的に記録させる記録制御手段とを備え、前記黒色インクの濃度の種類を前記いずれのカラーインクについてのカラーインクの濃度の種類よりも多くしたことを特徴とする画像記録装置。

【請求項 2】 前記画像記録装置は、医療用画像の記録に用いられることを特徴とする請求項 1 に記載の画像記録装置。

【請求項 3】 前記第 1 の記録ノズル群は、少なくとも 1 種類のカラーインクについて、濃淡 2 種類以上の濃度の異なるインクを吐出可能な複数のノズル群を有することを特徴とする請求項 1 又は 2 に記載の画像記録装置。

【請求項 4】 前記記録制御手段は、同一の記録媒体に、カラー画像と、該カラー画像の各単色についての濃度階調よりも高いモノクロ画像とを記録可能とすることを特徴とする請求項 1 乃至 3 のいずれか 1 項に記載の画像記録装置。

【請求項 5】 前記記録制御手段は、同一の記録媒体に、カラー画像とモノクロ画像とを記録領域を分けて記録することを特徴とする請求項 4 に記載の画像記録装置。

【請求項 6】 前記記録制御手段は、外部機器より送られてきた画像信号に基づき、カラー画像記録領域とモノクロ画像記録領域に分けて記録することを特徴とする請求項 5 に記載の画像記録装置。

【請求項 7】 前記カラーインクは、シアン、マゼンタ、イエローの 3 種類、若しくはレッド、グリーン、ブルーの 3 種類であることを特徴とする請求項 1 乃至 6 のいずれか 1 項に記載の画像記録装置。

【請求項 8】 前記カラーインクの濃淡の種類は、最大 2 種類であり、前記黒色インクの濃淡の種類は 3 種類以上であることを特徴とする請求項 1 乃至 7 のいずれか 1 項に記載の画像記録装置。

【請求項 9】 前記第 1 及び第 2 の記録ノズル群において、所定の記録ノズル群にインクカートリッジを搭載してインクを供給し、残りの記録ノズル群にインク供給手段を接続してインクを供給することを特徴とする請求項 1 乃至 8 のいずれか 1 項に記載の画像記録装置。

【請求項 10】 前記カラーインクはインクカートリッジにより供給され、前記黒色インクは前記インク供給手段により供給されることを特徴とする請求項 9 に記載の画像記録装置。

【請求項 11】 前期第 1 及び第 2 の記録ノズル群は更に複数のノズル群を有し、この複数のノズル群のうち一部のノズル群にはインクカートリッジからインクが供給されることを特徴とする請求項 1 に記載の画像記録装置。

されることを特徴とする請求項 1 に記載の画像記録装置。

【請求項 12】 少なくとも 1 種類のカラーインクを吐出可能な第 1 の記録ノズル群と、黒色インクを吐出可能な第 2 の記録ノズル群と、該第 1 及び第 2 の記録ノズル群を記録媒体に対して相対的に移動させつつ、該記録媒体にインクを吐出させて、カラー画像とモノクロ画像とを選択的に記録させる記録制御手段とを備え、前記黒色インクの濃度の種類を前記いずれのカラーインクについてのカラーインクの濃度の種類よりも多くしたことを特徴とした画像記録装置において、

前記記録制御手段は、同一の記録媒体に、カラー画像と、該カラー画像の各単色についての濃度階調よりも高いモノクロ画像とを記録可能とすると共に、同一の記録媒体に、カラー画像とモノクロ画像とを記録領域を分けて記録することを特徴とする画像記録装置の制御方法。

【請求項 13】 前記記録制御手段は、外部機器より送られてきた画像信号に基づき、カラー画像記録領域とモノクロ画像記録領域に分けて記録することを特徴とする請求項 12 に記載の画像記録装置の制御方法。

【請求項 14】 前記カラーインクは、シアン、マゼンタ、イエローの 3 種類、若しくはレッド、グリーン、ブルーの 3 種類であることを特徴とする請求項 12 又は 13 に記載の画像記録装置の制御方法。

【請求項 15】 前記カラーインクの濃淡の種類は、最大 2 種類であり、前記黒色インクの濃淡の種類は 3 種類以上であることを特徴とする請求項 12 乃至 14 のいずれか 1 項に記載の画像記録装置の制御方法。

【請求項 16】 前記第 1 及び第 2 の記録ノズル群において、所定の記録ノズル群にインクカートリッジを搭載してインクを供給し、残りの記録ノズル群にインク供給手段を接続してインクを供給することを特徴とする請求項 12 乃至 15 のいずれか 1 項に記載の画像記録装置の制御方法。

【請求項 17】 前期第 1 及び第 2 の記録ノズル群は更に複数のノズル群を有し、この複数のノズル群のうち一部のノズル群にはインクカートリッジからインクが供給されることを特徴とする請求項 12 に記載の画像記録装置の制御方法。

【請求項 18】 濃度が異なる複数の黒色インクと、カラーインクを用いて階調記録を行なう記録装置において、

前記複数の黒色インクによって表現可能な階調数の方が、前記カラーインクによって表現可能な階調数より多いことを特徴とする記録装置。

【請求項 19】 前記濃度が異なる複数の黒色インクの組み合せテーブルと、濃度が異なるカラーインクの組み合せテーブルとを有し、黒色インクに対応した前記テーブルの階調数の方が、カラーインクに対応した前記テーブルの階調数より多いことを特徴とする請求項 18 に記

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載の記録装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は画像記録装置及びその制御方法並びに記録装置に関する。

【0002】

【従来の技術】近年、カラー画像を記録媒体上に記録可能なカラープリンタが普及している。しかし、カラープリンタで文字等のモノクロ画像を記録しようとすると、後述のように記録速度が遅くなる等の問題があるため、カラー画像記録用のカラーインクヘッドと2値画像記録用の黒インクヘッドを両方搭載することで、必要に応じてカラーインクヘッドと黒インクヘッドを使い分けて同一の記録媒体にカラー画像とモノクロ画像を記録可能としたカラープリンタが提案されている。

【0003】

【発明が解決しようとする課題】ところで、X線写真やCT・MRI画像等を用いる医療分野では依然としてモノクロ画像が多用されている。その理由は、人間の目の濃度分解能が高いため、高い濃度分解能が要求される医療分野等においては、モノクロ画像の方がカラー画像よりも目で認識できる情報量が多いためである。

【0004】更に、反射式の記録媒体を用いるよりも透過式の記録媒体を用いる方が、人間の目で認識できる濃度分解能が高くなることが知られている。一般的に、カラー画像に対する人間の目の濃度分解能は8ビット程度であるのに対し、モノクロ透過画像については10乃至11ビットと言われている。

【0005】そして、X線写真やCT・MRI画像を透過式の記録媒体に記録することで医療用画像として提供され、医者が人間の目の濃度分解能限度において画像を読み取ることで診断結果が得られる。ところが、同じ医療分野に用いられる画像でも、超音波診断、核医学装置、内視鏡、眼底撮影画像、病理顕微鏡写真等は、生体の色情報を得る目的、或いは血流の状態等の生体の機能的な情報を表現する目的でカラー画像が多用されている。

【0006】そこで、従来はカラー画像記録用の記録装置と、モノクロ高階調画像記録用の記録装置とを別々に用意してこれらを使い分けていた。このため、同一の記録媒体に、カラー画像とモノクロ高階調画像とを記録することができず、記録した画像の管理も煩雑であった。

【0007】また、モノクロ画像を記録可能なカラー画像記録用の記録装置もあるが、モノクロ画像専用の記録装置に比べ階調表現で劣るという欠点がある。また、カラー画像記録用の記録媒体とモノクロ画像記録用の記録媒体とを用途に応じて夫々交換しながら使い分ける必要もあった。

【0008】このような記録装置の一例として、昇華型熱転写方式のものがある。これは、Y、M、C、若しく

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はR、G、Bの3種類のインクリボン（染料）を用意し、インクリボンと被記録媒体を重ねた状態で、サーマルヘッドで部分的に加熱し、インクリボンの染料を媒体に転写することで画像を形成するものである。3種類のインクリボンについて同じプロセスを3回繰り返すことで、カラー画像を形成することができる。この方式で、モノクロを記録するには、3種類のインクを全て均等に重ねればよい。しかし、この方式では、3種類のカラーを重ねてモノクロを表現するため、色味のない、中立のモノクロを表現することは難しい。また、特に透過媒体に対して、十分なモノクロの濃度（例えば、OD 3）を表現することはできない。

【0009】それゆえ、中立のモノクロ濃度、或いは十分に濃いモノクロ濃度を必要とする場合は、感熱式のモノクロ画像用媒体を別に用意し、上記サーマルヘッドで部分的に加熱し、加熱させた部分を黒化することで画像を得ていた。即ち、カラー画像用媒体とモノクロ画像用媒体とを交換すると共に、インクリボンを必要に応じて着脱するものであった。

【0010】もう1つの方法は、インクジェット方式である。この場合は、Y、M、C、若しくはR、G、Bの3種類のインクを用意しておき、3色を重ねることでカラー画像が表現できる。この場合も、モノクロを表現する場合は、3色を均等に重ねて表現することができる。しかし、この場合も昇華型熱転写方式と同様に、3色を重ねるため、色味のない、中立のモノクロを表現することは難しい。また、特に透過媒体に対して、十分なモノクロの濃度（例えば、OD 3）を表現するためには、インクを同じ画素に対して重ねなければならないが、媒体のインク吸収容量には限界があり、十分なモノクロ濃度を表現することはできなかった。即ち、画像に階調を出すため、また、濃度を濃くするため、同一画素にインクを重ね打ちするが、被記録媒体のインク吸収量には限界があり、この限界を超えて重ねると、インクが溢れ、画像がにじんでしまう。

【0011】本発明は、上述の課題に鑑みてなされ、その目的は、カラー画像とモノクロ高階調画像とで記録媒体やインクリボンを交換せずに記録でき、必要に応じて同一の記録媒体にカラー画像と品位の良いモノクロ高階調画像を記録可能な画像記録装置及びその制御装置並びに記録装置を提供することである。

【0012】

【課題を解決するための手段】上述の課題を解決し、目的を達成するため本発明の画像記録装置は、以下の構成を備える。即ち、少なくとも1種類のカラーインクを吐出可能な第1の記録ノズル群と、黒色インクを吐出可能な第2の記録ノズル群と、該第1及び第2の記録ノズル群を記録媒体に対して相対的に移動させつつ、該記録媒体にインクを吐出させて、カラー画像とモノクロ画像とを選択的に記録させる記録制御手段とを備え、前記黒色

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インクの濃度の種類を前記いずれのカラーインクについてのカラーインクの濃度の種類よりも多くした。

【0013】上記問題を解決するために、本発明では、Y、M、C若しくはR、G、Bのインクの内、濃淡の種類の最も多いカラーよりも多い種類の濃淡のモノクロインクを用意し、記録したい画像をモノクロ領域とカラー領域に分離し、カラー領域についてはカラーインクで、モノクロ領域についてはモノクロインクで記録する。

【0014】また、本発明の画像記録装置の制御方法は、以下の特徴を備える。即ち、少なくとも1種類のカラーインクを吐出可能な第1の記録ノズル群と、黒色インクを吐出可能な第2の記録ノズル群と、該第1及び第2の記録ノズル群を記録媒体に対して相対的に移動させつつ、該記録媒体にインクを吐出させて、カラー画像とモノクロ画像とを選択的に記録させる記録制御手段とを備え、前記黒色インクの濃度の種類を前記いずれのカラーインクについてのカラーインクの濃度の種類よりも多くした画像記録装置において、前記記録制御手段は、同一の記録媒体に、カラー画像と、該カラー画像の各単色についての濃度階調よりも高いモノクロ画像とを記録可能とすると共に、同一の記録媒体に、カラー画像とモノクロ画像とを記録領域を分けて記録する。これにより、同一画素に対する重ね打ち回数を少なくして、且つモノクロの階調と高濃度を表現することが可能となった。また、本発明の記録装置は、以下の構成を備える。即ち、濃度が異なる複数の黒色インクと、カラーインクを用いて階調記録を行なう記録装置において、前記複数の黒色インクによって表現可能な階調数の方が、前記カラーインクによって表現可能な階調数より多い。

【0015】

【発明の実施の形態】以下に、本発明の実施形態について添付図面を参照して詳細に説明する。

【機械的構成】図1は、本発明に係る実施形態のインクジェット記録装置の主要部（記録部）を示す斜視図であり、図2Aは図1の矢視Aから見た側面図であり、図3、図4A及び図4Bは、図1の記録ヘッドの部分詳細図である。

【0016】図1及び図2Aにおいて、501は画像を記録されるシート、502、503と、504、505はそれぞれ対になってシートをX方向に搬送するローラである。ローラ505は、長手方向に所定間隔で拡径部506が設けられ、拡径部506がシートに接触する。507はモータ、508はモータ軸に取り付けられたブーリ、509、510はローラ502、504の一端に取り付けられたブーリで、ベルト511によってブーリ508に結合されており、モータの回転によってローラ502、504が回転するようになっている。また、ローラ503、505は、不図示の付勢手段により、ローラ502、504を夫々押圧する方向に付勢されていて、各ローラでシートを挟み込んでX方向に搬送するよ

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うになっている。

【0017】512は、複数のヘッド513a～513lを搭載するキャリッジで、各ヘッドには、図4Aに示すように、多数のノズルがシート面に対向する位置に設けられている。516、517は、キャリッジを摺動可能に保持するシャフトで、516はキャリッジに設けられた孔518を貫通し、また、キャリッジ512に延設された突起部519がシャフト517上に当接する構造になっている。

【0018】以上の構成によって、ヘッド513のノズルの設けられた面が所定間隔dでシートに対向するように配置される。520は、一部をキャリッジ512に固定されたベルトで、モータ521の駆動軸に取り付けられたブーリ522及び固定軸523に回転可能に取り付けられたブーリ524との間を結合している。

【0019】以上の構成によって、モータ521の回転によってキャリッジがY方向に沿って往復移動可能となり、シートのY方向全域及び、キャリッジの待機位置512a及びシートに関して待機位置512aと対称な位置に移動可能となる。尚、シート上を移動する間に、ノズル面とシートの間隔dは、一定に保持されるように構成されている。526a～526lは、インクを入れたインクカートリッジで、ヘッド513a～513lに装着され、ヘッドにインクを供給するようになっている。ヘッドカートリッジ526は、ヘッド513に対し、着脱自在となっていて、インクカートリッジのインクがなくなったら、取り外して新しいインクカートリッジを取り付けることでインクを補給できるようになっている。

【0020】インクカートリッジは、12種類用意されている。その内訳は、526aから順番に、シアン濃淡2種類、マゼンタ濃淡2種類、イエロー濃淡2種類、黒インクで濃度が異なる6種類となっている。このインクカートリッジの種類に513g～513lの6つのノズル群を有する黒インク用の第2ノズル群と、513a～513fの6つのノズル群を有するカラーインク用の第2ノズル群とが対応している。尚、これらのインクを用いるかわりに、526aから順番に、レッド濃淡2種類、グリーン濃淡2種類、ブルー濃淡2種類、黒インクで濃度が異なるものとしても良い。これらの異なるカートリッジは、それぞれヘッド523a～523lに装着可能となっている。525はローラ502、504間に設けられたシートガイドで、シートに接する面に設けられた多数の小孔から、不図示の吸引手段により図2Aの下方に向かってエアによりシートを吸引し、その吸引力によってシートがシートガイドに密着することでシートの浮き上がりを防止している。シートが浮き上がると、当然間隔dを保持できなくなり、また、シートがヘッドに衝突する場合もある。515はノズルからシート上にインクを吐出した時にシート上に形成されるドットである。

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【0021】尚、本例では、各色ごとに別々なヘッドで構成しているが、複数の色又は濃度のヘッドを一体構成とし、1つのヘッドの中を複数のノズル群に分け、それぞれのノズル群ごとに色又は濃度を割り当てるようにしてもよい。

【電気回路構成】図5は本実施形態のインクジェット記録装置の各種制御を司る制御回路のブロック図である。

【0022】図5に示すように、1はスキャナ等の画像入力部で外部機器やネットワークを通じて画像データが入力される。1'は画像領域分離部で、画像入力部1に入力された画像データをモノクロ画像領域とカラー画像領域に分け、各領域について、モノクロ画像領域であれば各画素に対する濃度データ、カラー画像領域であればシアン、マゼンタ、イエローもしくは、レッド、グリーン、ブルーの3色に色分解されたそれぞれのカラーについての各画素に対する濃度データを得る。2は各種パラメータの設定および印字開始を指示する各種キーを備えている操作部、3は記憶媒体中の各種プログラムに従つて本記録装置全体を制御するCPUである。

【0023】4は制御プログラムやエラー処理プログラムに従つて本記録装置を動作させるためのプログラムなどを格納している記憶媒体である。本実施形態の動作はすべてこのプログラムによる動作である。該プログラムを格納する記憶媒体4としては、ROM、FD、CD-ROM、HD、メモリカード、光磁気ディスクなどを用いることができる。

【0024】記憶媒体4において4aはガンマ変換処理で参照するためのガンマ補正変換テーブル、4bは後述のインク種分配の処理で参照するためのインク種分配テーブル（インク種組み合せテーブル）、4dは各種プログラムを格納しているプログラム群をそれぞれ示している。

【0025】5は記憶媒体4中の各種プログラムのワークエリア、エラー処理時の一時待避エリア及び画像処理時のワークエリアとして用いるRAMである。また、RAM5は、記憶媒体4の中の各種テーブルをコピー後、そのテーブルの内容を変更し、この変更したテーブルを参照しながら画像処理を進めることも可能である。

【0026】6は入力画像を元に、インクジェットで階調を実現するための吐出パターンを作成する画像処理部である。

【0027】7は記録時に画像処理部で作成された吐出パターンに基づいてドット画像を形成するプリンタであり、図1に示した記録部を含んでいる。8は本装置内のアドレス信号、データ、制御信号などを伝送するバスラ

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インである。

【画像処理部】次に、図6を参照して画像処理部6について説明する。

【0028】ガンマ補正処理11は画像入力部1で入力される画像信号CVを、モノクロ及びカラー各色についてそれぞれ用意されたガンマ補正変換テーブル4aを用いて濃度を表す信号CDに変換し、RAM5の画像処理ワークエリアのページメモリ領域に格納する。この実施形態では、CD値のレベル分けを、モノクロ画像は12ビット、カラー各色について夫々8ビットとしている。

【0029】注目画素選択12は、ページメモリ領域内のこれから処理をしようとする一画素を選択し、濃度データCDを得る。

【0030】インク種分配処理13では注目画素のCD値をもとにインク種分配テーブル4bを参照し、注目画素の濃度CDに近い濃度を表現するインク種の組み合わせを選択する。濃度誤差計算15では、インク種分配処理13で選択されたインクの組合せで表現できる濃度と注目画素のCD値との差分を算出する。この組合せに基づきも各濃度のヘッドの吐出、不吐出の2値信号d1, d2, d3, …が決定される。

【0031】誤差拡散処理16では、前記差分を所定方法にて未だインク種分配処理をしていない周辺の画素に振り分け、該当画素のCD値に加算若しくは減算をする。

【0032】以上の処理を行うことにより、注目した一画素の処理が終了する。

【0033】ここで、インク種分配テーブル4bについて説明する。インクの種類や濃度に関するインク種分配テーブル4bには、使用するインクや記録した際の濃度情報等が記録されていて、本実施形態においては、以下に示すようなCMY各色の濃淡インクの使用組み合わせとその濃度情報、及び無彩色領域での黒に対する濃淡インクの使用組み合わせとその濃度情報が含まれる。CMYに対しては合計6種類、黒系色6種類であり、濃淡インクは濃度の高い方から順に1、2、3…と添え字で示す。これらのインクの染料濃度比率を表1に示す。表1は各種インクの染料濃度比と反射濃度を示している。なお、インクは染料及び溶媒からなり、溶媒には界面活性剤、保湿材等の各種添加剤が含まれている。これら添加剤は、ヘッドからの吐出特性、受像紙上の吸収特性とを制御するものである。

【0034】

【表1】

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	C1	C2	M1	M2	Y1	Y2
染料濃度 比率 (%)	3.5%	0.9%	3.5%	0.9%	3.5%	0.9%
反射濃度 (O.D.)	1.88	0.51	1.58	0.59	1.58	0.59

	K1	K2	K3	K4	K5	K6
染料濃度 比率 (%)	4.8%	2.4%	1.2%	0.6%	0.3%	0.15%
反射濃度 (O.D.)	1.87	0.96	0.51	0.27	0.13	0.07

【0035】これらインクを用いて、CMYに対しては1画素を最大2つのインクドットで形成し、Kに対しては無彩色領域においては1画素を最大4つのインクドットで形成する。この結果を図2B及び図2Cに示す。図中の数字は、1つの画素に吐出するインクドットの数を示し、零はそのインクを吐出しないことを示している。また、濃度レベルの欄は、CMYでは8ビット入力画像信号(0～255:0が最高濃度)に対応させた値を示している。即ち、CMYに関しては5値の多値化処理を行い、Kに関しては12ビット入力画像信号(0～4095:0が最高濃度)に対応して無彩色領域で43値の多値化処理を行うことになる。以上のように、本実施形態においては有彩色(Y、M、C)インクで記録を行う場合には図2Bで示されるような各色のインクは5つの濃度レベルに対応できるテーブルが用意されており、無彩色(BK)インクで記録を行う場合には図2Cで示されるように有彩色(Y、M、C)インクの濃度レベル(階調表現数)より多い42の濃度レベルに対応できるテーブルが用意されている。記録を行う場合には、それぞれ記録すべき階調値に対応したインク種の組み合わせ

を選択して記録を行う。画像の濃度データCDをもとに、前述の注目画素選択12とインク種分配処理13の処理を全画素数繰り返すことにより、異なる濃度を持つそれぞれのヘッドに対する各画素ごとの吐出、不吐出の2値信号d1, d2, d3, …が形成される。以上の処理を、モノクロ画像及び、カラー画像の各色について、それぞれのインク種分配テーブルを用いて順次行う。尚、モノクロ及び各色についてそれぞれ画像処理部を設けておき、並列で処理しても良い。

【0036】記録を行う場合には、図2Aで、不図示の手段によりシート501が図の左方向からローラ502、503の間に送り込まれる。ついでシートは、モーター507により、所定距離ずつ間欠的にX方向に送られる。シートが停止している間に、モーター521が回転し、キャリッジをY方向に一定のスピードで移動させる。キャリッジ上のヘッドが、シートの上を通過する間に、図5、図6の制御回路により、画像信号に対応したノズル吐出指令信号が送られ、これに従って各ノズルから選択的に液滴が吐出される。ヘッドがシート上を通過して、シート上から離れた位置にある間にモーター50

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7がシートを所定距離X方向に移動して停止し、ここで再びモーター507がシートを所定スピードで移動させ、同様に選択的に液滴を吐出させる。以下これを繰り返すことで、最終的にシート上に所望の画像が記録される。記録が終了したシートは、504、506にて図2Aの左方向に搬送され、ついで不図示の搬送手段で図2Aの左方向に排出される。

【0037】図7に、本記録装置による記録例を示す。531はX線画像、532はCT画像、533はMR I画像で、これらはいずれもモノクロ画像で12ビットで階調表現されている。534は内視鏡画像、535は眼底画像で、この2つはカラー画像であり、各色8ビットで階調表現されている。このように、1枚のシートに、例えば、同一患者の画像をまとめて記録しておけば、対応が容易で便利である。

【0038】図8は別な画像の記録例である。537はカラードップラー超音波画像であり、大部分はモノクロ高階調画像であるが、黒部538のみカラー画像となつていて、血流の状態を色別に表現している。

【0039】このように3種類以上の黒濃淡インクを用いて高階調記録するアルゴリズムについては、例えば特願平9-78423号に記載されている。また、濃淡2種類のカラーインクを用いてカラー画像を記録するアルゴリズムは、例えば、特開平6-226998号に記載されている。モノクロ画像とカラー画像を領域を分けて記録する場合は、それぞれの領域に対してそれぞれのアルゴリズムで記録すれば良い。

【第2の実施形態の画像記録装置】図9は第2の実施形態の画像記録装置を示す。

【0040】図9において図1と同一の構成部分は省略している。

【0041】図9において、ヘッド513には、リザーブタンク540a～5401が取り付けられていて、一定量のインクが蓄積されている。リザーブタンク540a～5401からは、各1本ずつチューブ541がつながり、このチューブはそれぞれポンプ手段545a～5451を経由して対応するインクタンク544a～5441につながっており、リザーブタンクのインク量が少なくなったら、ポンプ手段によりインクタンクからリザーブタンクにインクを補給するようになっている。インクタンクは、不図示の着脱機構によりチューブを着脱可能となっていて、また、チューブをはずした状態で装置に着脱可能に構成されており、インクタンクが空になつた場合には、チューブを抜いて、インクタンクを新しいものと交換し、再びチューブを装着することでインクの補給をするようになっている。インクの種類は第1の実施形態と同様である。チューブは、チューブ束542にまとめられ、中間部をチューブ固定部材543で固定されている。チューブ束は、リザーブタンクとチューブ固定部材の間はチューブガイド546に乗つていてキャリ

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ッジが移動する際、キャリッジの移動を妨げないようにチューブガイド上を移動自在になっている。

【0042】記録動作については、第1の実施形態と同様であるが、インクタンクの容量はインクカートリッジの容量よりずっと多いので、大量に記録する場合には、インクカートリッジの交換の頻度に比べて、インクタンクの交換頻度は少なく、インク補給の頻度が少なくなる。

【第3の実施形態の画像記録装置】図10は第3の実施形態の画像記録装置を示す。図10において、図1及び図9と同一の構成部分は省略している。

【0043】図10において、ヘッド513a～513fには、インクカートリッジ526a～526fが図1と同様に取り付けられ、ヘッド513g～513lにはリザーブタンク540g～540lが図9と同様に取り付けられている。リザーブタンクには図9と同様それぞれ1本のチューブが接続され、ポンプ手段545g～545lを経由してインクタンク544g～544lに接続されている。そして、ヘッド513a～513fについては、インクカートリッジを交換することでインクを補給し、ヘッド513g～513lについては、インクタンク544g～544lを交換することによりインクを補給する。これにより、インクのチューブ、インクタンク、ポンプの数が図9の場合より減少し、装置が簡素化される。他方、ヘッド513a～513fについては、図9の場合よりインクカートリッジ交換の手間が増えるが、通常、図7や図8のような画像を記録する場合、以下に説明する理由によりカラー領域は少ないので支障は少ない。

【0044】即ち、通常、X線画像やCT・MR I等のモノクロ高階調を要求される画像は、シートも大きい傾向がある。例えばカラー画像はA4サイズが良く用いられ、モノクロ高階調画像は半切サイズ(35×43cm)が良く使われる。また、モノクロ高階調画像は、最高濃度を例えばOD値3.0程度に濃く記録する場合が多い。

【0045】以上のように、画像記録装置を医療用画像に用いる場合には、黒インクの消費量がカラーインクの消費量に比べて著しく多いという特徴がある。よって、相対的に使用量の少ないカラーインクについては、カートリッジで補給しても、さほど交換頻度が増えない。つまり、図10の構成としてもインク補給の手間があまり増えず、装置も簡素化できる。

【他の実施形態】インクジェットの方式については、特に制限はない。本例では、液体のインクを用いる例を述べたが、固形のインクを溶かして吐出するものでもよい。この場合は、インクの補給は固形インクを交換することになる。

【0046】シートの大きさは、1種類に限らない。とりわけ、モノクロ画素とカラー画像とでは、好んで使用

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されるシートのサイズが異なるので、複数のシートを使用できることで本発明のメリットは増す。

【0047】シートは反射、透過いずれでもよい。医療用画像では、反射シートはカラー画像、モノクロ画像は透過シートが好んで使用されるので、反射シートでも透過シートでも使用できることは、本発明のメリットを増す。

【0048】シートを間欠に送り、シートが停止している間にシート送り方向と直交する方向にヘッドを移動させて記録する本実施形態にとどまらず、シートを定速で送り、シートの送り方向と直交する方向にシート幅をカバーするようにライン状の固定ヘッドを設け、シートが定速で送られる間に記録を行う方式でも良い。この場合は、それぞれことなるインクについてシートの幅をカバーする長さのヘッドを装着しておく。

【0049】第3の実施形態で、黒インクをチューブ供給方式とし、カラーインクをカートリッジ方式としたが、チューブ供給方式は黒インクの一部でも良い。この場合は、使用量の多いインクをチューブ方式にするのが妥当である。医療用画像の場合は、背景が最高濃度で記録される場合が多いので、濃い黒インクが使用量が多い傾向がある。そこで、濃い黒インクをチューブ供給とすることが考えられる。また、逆に、カラーインクをチューブ供給方式とし、黒インクをカートリッジ方式とすれば、カラー画像が主として使用され、モノクロ画像は使用頻度が少ない場合に好適である。

【0050】カラーインクは一部のみ構成しても良い。例えば、医療用の生体画像を記録するのではなく、モノクロ画像にアクセントをつける、層別のためにカラーで目印をつける、注記を記入する、といった場合には、フルカラーの必要もなく、一部のカラーインクのみ使用できれば良い。

【0051】また、1枚のモノクロ領域とカラー領域の含まれる画像からモノクロ領域とカラー領域に分離する場合だけでなく、1枚の画像のモノクロ領域の画像信号とカラー領域の画像信号を別々に受取り、1枚の媒体に記録してもよい。また、複数枚のモノクロ画像及びカラー画像を受取り、1枚の媒体に領域を分けて記録してもよい。

【0052】以上の実施の形態は、特にインクジェット記録方式の中でも、インク吐出を行わせるために利用されるエネルギーとして熱エネルギーを発生する手段（例えば電気熱変換体やレーザ光等）を備え、前記熱エネルギーによりインクの状態変化を生起させる方式を用いることにより記録の高密度化、高精細化が達成できる。

【0053】その代表的な構成や原理については、例えば、米国特許第4723129号明細書、同第4740796号明細書に開示されている基本的な原理を用いて行うものが好ましい。この方式はいわゆるオンデマンド型、コンティニュアス型のいずれにも適用可能である

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が、特に、オンデマンド型の場合には、液体（インク）が保持されているシートや液路に対応して配置されている電気熱変換体に、記録情報に対応して膜沸騰を越える急速な温度上昇を与える少なくとも1つの駆動信号を印加することによって、電気熱変換体に熱エネルギーを発生せしめ、記録ヘッドの熱作用面に膜沸騰を生じさせて、結果的にこの駆動信号に1対1で対応した液体（インク）内の気泡を形成できるので有効である。この気泡の成長、収縮により吐出用開口を介して液体（インク）を吐出させて、少なくとも1つの滴を形成する。この駆動信号をパルス形状をすると、即時適切に気泡の成長収縮が行われるので、特に応答性に優れた液体（インク）の吐出が達成でき、より好ましい。

【0054】このパルス形状の駆動信号としては、米国特許第4463359号明細書、同第4345262号明細書に記載されているようなものが適している。なお、上記熱作用面の温度上昇率に関する発明の米国特許第4313124号明細書に記載されている条件を採用すると、さらに優れた記録を行うことができる。

【0055】記録ヘッドの構成としては、上述の各明細書に開示されているような吐出口、液路、電気熱変換体の組み合わせ構成（直線状液流路または直角液流路）の他に熱作用面が屈曲する領域に配置されている構成を開示する米国特許第4558333号明細書、米国特許第4459600号明細書を用いた構成も本発明に含まれるものである。加えて、複数の電気熱変換体に対して、共通するスロットを電気熱変換体の吐出部とする構成を開示する特開昭59-123670号公報や熱エネルギーの圧力波を吸収する開口を吐出部に対応させる構成を開示する特開昭59-138461号公報に基づいた構成としても良い。

【0056】さらに、記録装置が記録できる最大記録媒体の幅に対応した長さを有するフルラインタイプの記録ヘッドとしては、上述した明細書に開示されているような複数記録ヘッドの組み合わせによってその長さを満たす構成や、一体的に形成された1個の記録ヘッドとしての構成のいずれでもよい。

【0057】加えて、上記の実施の形態で説明した構成と異なる構成として記録ヘッド自体に一体的にインクタンクが設けられたカートリッジタイプの記録ヘッドの構成でもよく、これに限らず、装置本体に装着されることで、装置本体との電気的な接続や装置本体からのインクの供給が可能になる交換自在のチップタイプの記録ヘッドを用いてもよい。

【0058】また、以上説明した記録装置の構成に、記録ヘッドに対する回復手段、予備的な手段等を付加することは記録動作を一層安定にできるので好ましいものである。これらを具体的に挙げれば、記録ヘッドに対してのキャッピング手段、クリーニング手段、加圧あるいは吸引手段、電気熱変換体あるいはこれとは別の加熱素子

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あるいはこれらの組み合わせによる予備加熱手段などがある。また、記録とは別の吐出を行う予備吐出モードを備えることも安定した記録を行うために有効である。

【0059】さらに、記録ヘッドを一体的に構成するか複数個の組み合わせによってでも良いが、また異なる色の複色カラー、または混色によるフルカラーの少なくとも1つを備えた装置とすることもできる。

【0060】以上説明した実施の形態においては、インクが液体であることを前提として説明しているが、室温やそれ以下で固化するインクであっても、室温で軟化もしくは液化するものを用いても良く、あるいはインクジェット方式ではインク自体を30°C以上70°C以下の範囲内で温度調整を行ってインクの粘性を安定吐出範囲にあるように温度制御するものが一般的であるから、使用記録信号付与時にインクが液状をなすものであればよい。

【0061】加えて、積極的に熱エネルギーによる昇温をインクの固形状態から液体状態への状態変化のエネルギーとして使用せしめることで積極的に防止するため、またはインクの蒸発を防止するため、放置状態で固化し加熱によって液化するインクを用いても良い。いずれにしても熱エネルギーの記録信号に応じた付与によってインクが液化し、液状インクが吐出されるものや、記録媒体に到達する時点では既に固化し始めるもの等のよう、熱エネルギーの付与によって初めて液化する性質のインクを使用する場合も本発明は適用可能である。このような場合インクは、特開昭54-56847号公報あるいは特開昭60-71260号公報に記載されるような、多孔質シート凹部または貫通孔に液状または固形物として保持された状態で、電気熱変換体に対して対向するような形態としてもよい。本発明においては、上述した各インクに対して最も有効なものは、上述した膜沸騰方式を実行するものである。

【0062】さらに加えて、本発明に係る記録装置の形態としては、コンピュータ等の情報処理機器の画像出力端末として一体または別体に設けられるもの他、リーダ等と組み合わせた複写装置、さらには送受信機能を有するファクシミリ装置の形態を取るものであっても良い。

【0063】尚、本発明は、複数の機器（例えばホストコンピュータ、インターフェース機器、リーダ、プリンタなど）から構成されるシステムに適用しても、一つの機器からなる装置（例えば、複写機、ファクシミリ装置など）に適用してもよい。

【0064】また、本発明の目的は、前述した実施形態の機能を実現するソフトウェアのプログラムコードを記録した記憶媒体を、システムあるいは装置に供給し、そのシステムあるいは装置のコンピュータ（またはCPUやMPU）が記憶媒体に格納されたプログラムコードを読み出し実行することによっても、達成されることは言う

までもない。

【0065】この場合、記憶媒体から読み出されたプログラムコード自体が前述した実施形態の機能を実現することになり、そのプログラムコードを記憶した記憶媒体は本発明を構成することになる。

【0066】プログラムコードを供給するための記憶媒体としては、例えば、フロッピディスク、ハードディスク、光ディスク、光磁気ディスク、CD-ROM、CD-R、磁気テープ、不揮発性のメモリカード、ROMなど用いることができる。

【0067】また、コンピュータが読み出したプログラムコードを実行することにより、前述した実施形態の機能が実現されるだけでなく、そのプログラムコードの指示に基づき、コンピュータ上で稼働しているOS（オペレーティングシステム）などが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

【0068】さらに、記憶媒体から読み出されたプログラムコードが、コンピュータに挿入された機能拡張ボードやコンピュータに接続された機能拡張ユニットに備わるメモリに書き込まれた後、そのプログラムコードの指示に基づき、その機能拡張ボードや機能拡張ユニットに備わるCPUなどが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

【0069】

【発明の効果】以上のように、本発明によれば、少なくとも1種類のカラーインクを吐出可能な第1の記録ノズル群と、濃度が異なる少なくとも2種類の黒色インクを吐出可能な第2の記録ノズル群と、第1及び第2の記録ノズル群を記録媒体に対して相対的に移動させつつ、この記録媒体にインクを吐出させて、カラー画像とモノクロ画像とを選択的に記録させる記録制御手段とを備え、黒色インクの濃度の種類をいずれのカラーインクについてもカラーインクの濃度の種類よりも多くしたことにより、カラー画像とモノクロ画像とで記録媒体を交換せずに記録でき、必要に応じて同一の記録媒体にカラー画像とモノクロ画像を記録可能となる。

【図面の簡単な説明】

【図1】本実施形態のインクジェット記録装置の主要部を示す斜視図である。

【図2A】図1の矢視Aの側面図である。

【図2B】有彩色インクで記録を行う場合の各色インクの濃度レベルに対応するテーブルを示す図である。

【図2C】無彩色インクで記録を行う場合のインクの濃度レベルに対応するテーブルを示す図である。

【図3】図1の部分詳細図である。

【図4A】図1の部分詳細図である。

【図4B】図1の部分詳細図である。

【図5】本実施形態のインクジェット記録装置の制御ブ

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ロック図である。

【図6】画像処理部のブロック図である。

【図7】画像の記録例を示す図である。

【図8】画像の記録例を示す図である。

【図9】第2の実施形態のインクジェット記録装置を示す図である。

【図10】第3の実施形態のインクジェット記録装置を示す図である。

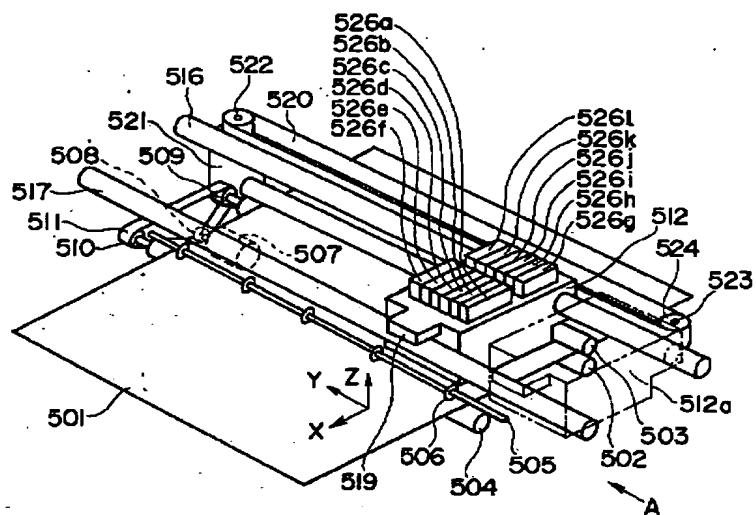
【符号の説明】

- 1 画像入力部
- 2 画像領域分離部
- 3 操作部
- 4 C P U

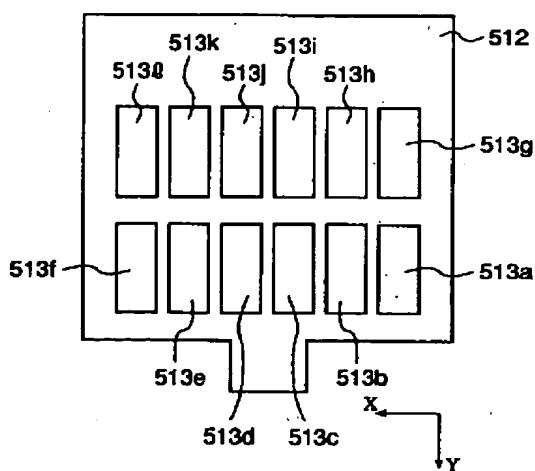
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- 4 記憶媒体
- 5 RAM
- 6 画像処理部
- 501 シート
- 512 キャリッジ
- 513a～5131 ヘッド
- 514 ノズル
- 526a～5261 インクカートリッジ
- 531～538 画像の記録例
- 10 540a～5401 リザーブタンク
- 541 チューブ
- 545 ポンプ手段
- 544 インクタンク

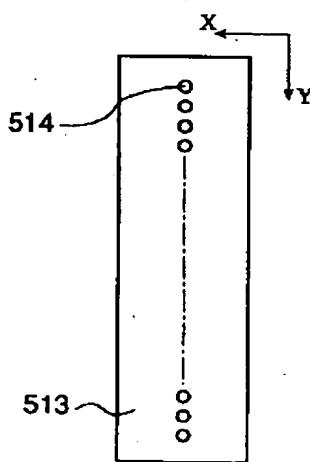
【図1】



[図3]



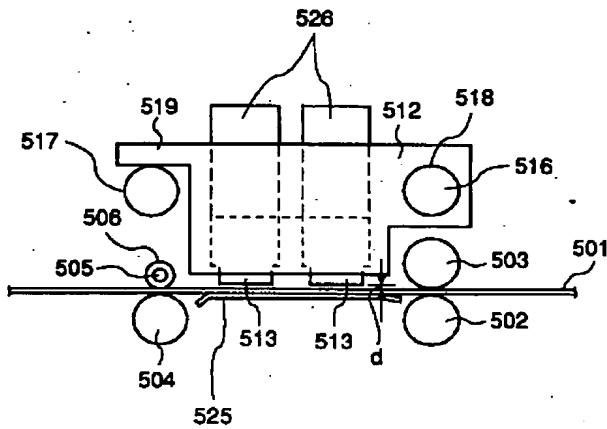
[図4A]



[図4B]

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【図2A】



【図2B】

No.	C1	C2	染料量	ドット数	反射濃度	濃度レベル dl[x]	th[x]
0	2	0	7.00	2	2.51	0	
1	1	0	3.50	1	1.88	66	33
2	0	2	1.80	2	0.90	164	115
3	0	1	0.90	1	0.51	204	184
4	0	0	0.00	0	0.00	255	229

No.	M1	M2	染料量	ドット数	反射濃度	濃度レベル dl[x]	th[x]
0	2	0	7.00	2	2.38	0	
1	1	0	3.50	1	1.58	86	43
2	0	2	1.80	2	0.86	163	124
3	0	1	0.90	1	0.49	203	183
4	0	0	0.00	0	0.00	255	229

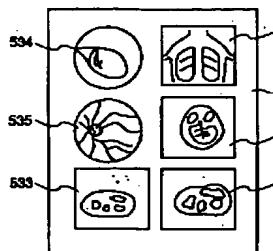
No.	Y1	Y2	染料量	ドット数	反射濃度	濃度レベル dl[x]	th[x]
0	2	0	7.00	2	2.38	0	
1	1	0	3.50	1	1.58	86	43
2	0	2	1.80	2	0.86	163	124
3	0	1	0.90	1	0.49	203	183
4	0	0	0.00	0	0.00	255	229

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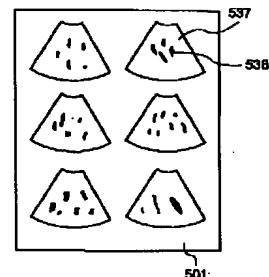
【図2C】

No.	K1	K2	K3	K4	K5	K6	染料量	ドット数	反射強度	濃度レベル dl[x]	th[x]
0	3	0	0	0	0	0	14.40	3	2.53	0	0
1	1	1	2	0	0	0	9.60	4	2.39	224	112
2	1	1	1	0	0	1	8.55	4	2.30	368	288
3	1	1	0	1	0	0	7.80	3	2.22	512	432
4	1	1	0	0	0	1	7.35	3	2.16	608	560
5	1	0	1	1	1	0	6.90	4	2.09	704	656
6	1	0	1	0	1	1	6.45	4	2.01	832	768
7	0	2	1	0	0	0	6.00	3	1.93	960	896
8	0	2	0	1	1	0	5.70	4	1.87	1056	1008
9	0	1	2	1	0	0	5.40	4	1.81	1168	1120
10	0	1	2	0	1	0	5.10	4	1.74	1280	1216
11	0	1	1	2	0	0	4.80	4	1.67	1392	1328
12	0	1	1	1	1	0	4.50	4	1.60	1504	1440
13	0	1	1	1	0	1	4.35	4	1.56	1568	1536
14	0	1	1	1	0	0	4.20	3	1.52	1632	1600
15	0	1	1	0	1	1	4.05	4	1.48	1696	1664
16	0	1	1	0	1	0	3.90	3	1.43	1760	1728
17	0	1	1	0	0	1	3.75	3	1.39	1840	1808
18	0	1	0	1	2	0	3.60	4	1.35	1904	1872
19	0	1	0	1	1	1	3.45	4	1.30	1984	1936
20	0	1	0	1	1	0	3.30	3	1.26	2048	2016
21	0	0	2	1	0	1	3.15	4	1.21	2128	2096
22	0	0	2	1	0	0	3.00	3	1.16	2208	2160
23	0	0	2	0	1	1	2.85	4	1.12	2288	2240
24	0	0	1	2	1	0	2.70	4	1.07	2368	2320
25	0	0	1	2	0	1	2.55	4	1.02	2448	2400
26	0	0	1	1	2	0	2.40	4	0.96	2528	2480
27	0	0	1	1	1	1	2.25	4	0.91	2608	2576
28	0	0	1	1	1	0	2.10	3	0.86	2704	2656
29	0	0	1	1	0	1	1.95	3	0.80	2784	2736
30	0	0	1	1	0	0	1.80	2	0.75	2860	2832
31	0	0	1	0	1	1	1.65	3	0.69	2960	2928
32	0	0	0	2	0	2	1.50	4	0.63	3056	3008
33	0	0	0	1	2	1	1.35	4	0.57	3152	3104
34	0	0	0	1	1	2	1.20	4	0.51	3248	3200
35	0	0	0	1	1	1	1.05	3	0.45	3344	3286
36	0	0	0	1	1	0	0.90	2	0.39	3456	3392
37	0	0	0	1	0	1	0.75	2	0.33	3552	3504
38	0	0	0	0	1	2	0.60	3	0.27	3648	3600
39	0	0	0	0	1	1	0.45	2	0.20	3760	3712
40	0	0	0	0	0	2	0.30	2	0.13	3856	3808
41	0	0	0	0	0	1	0.15	1	0.07	3968	3920
42	0	0	0	0	0	0	0.00	0	0.00	4080	4032

【図7】

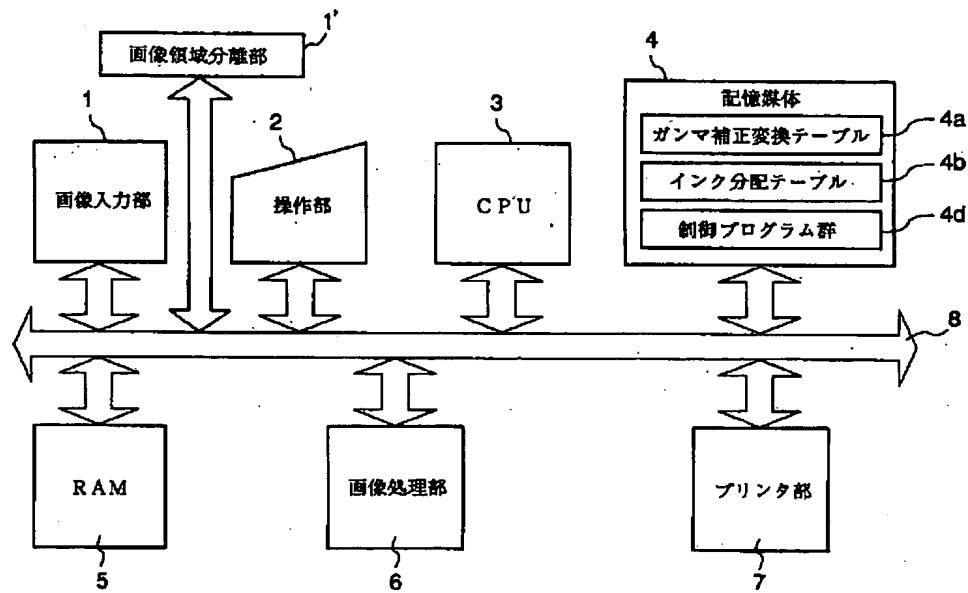


【図8】

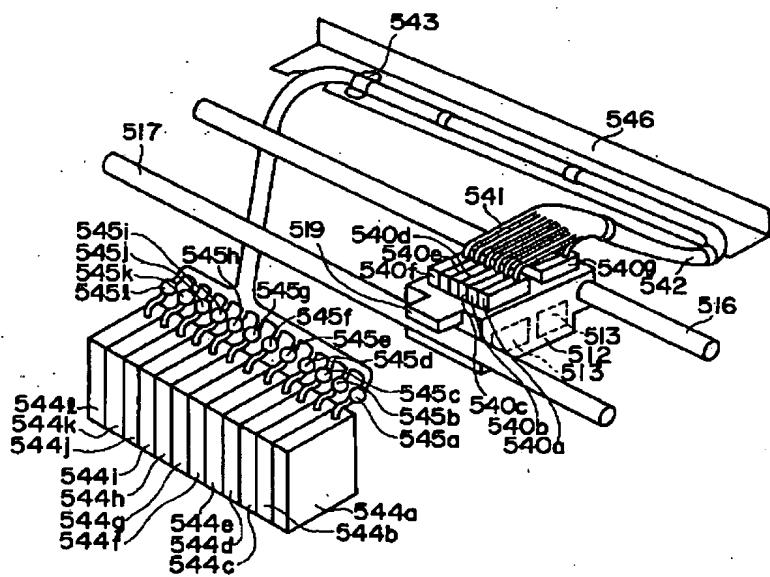


(13)

【図5】

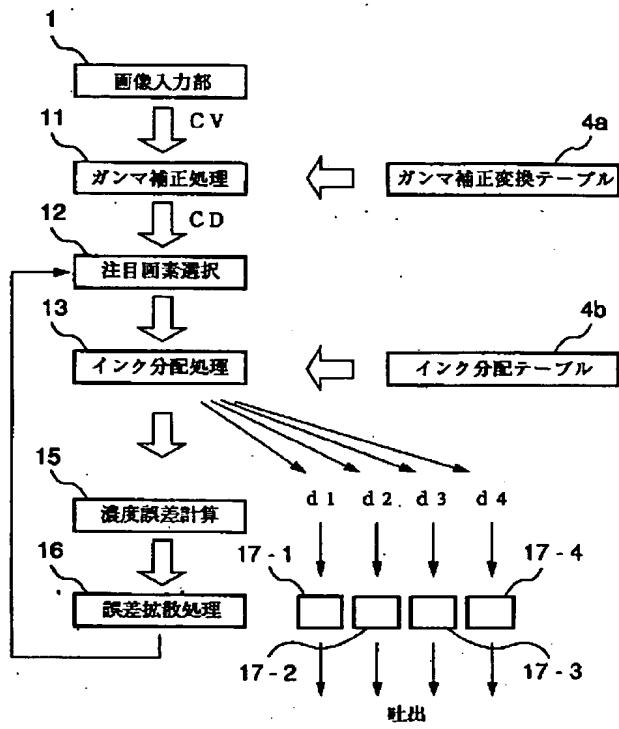


【図9】



(14)

【図6】



(15)

【図10】

